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Cost Finding to Assure Profits—I

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Uniform accounting is essential if industry is to take full advantage of the trade practice possibilities of NRA codes. And to make a virtue of a necessity it is most important that the methods chosen shall be those that return the highest degree of profit assurance. In the first article of a series, the author tells what uniform cost-finding can do

EVERYONE realizes, of course, that the end and aim of all business is profit and nothing else. Like anything worth having, profits must be intelligently planned for —not merely hoped for.

It is not true that "hindsight is better than foresight." Grant that it is more common and often more accurate—but never "better."

In managing a business nowadays there is no sufficient reason why foresight cannot be almost as accurate as hindsight; yet in a large proportion of all enterprises there is next to no intelligent foresight for the reason that either the necessary means for foretelling the results of present and future activities are lacking or, having the means, the management fails to make maximum use of them.

When orders are easy to get and prices are high, management is inclined to take an easy-come-easy-go attitude and to allow gross extravagances, that eat up possible profits, to creep in. When business is in a slump the struggle is to keep losses as small as possible. To that end useful methods that might show the way to economical operation are often discarded in a short-sighted effort to economize. Or, in the blind hope that a sufficient volume of sales will somehow bring profits, what the cost figures show is ignored, and prices are cut unintelligently in needless ignorance of what the effect will be on profits.

The business without accurate modern cost methods is strikingly like a ship without charts or compass. To bring the business ship into the port of profits regularly, the course must be charted well in advance. Sharp watch must be kept of the compass, the eye kept open for buoys, lighthouses and landmarks, and the ear acute to hear foghorns.

To chart the course of a business is, or should be, much easier than to bring a ship safely to port. The guides a business man needs most can be concentrated in his accounting and cost-finding information. Danger points shriek at him like a siren.

Costs Show Up Weak Spots

But, like a ship-master, the business executive must not expect the charts, the compass nor the danger signals automatically to steer his ship. He has to do that—in the light of what his charts and signals tell him. Cost methods, contrary to the convictions of some executives, will not of themselves make betterments. They will not run the business for him. They are no substitute for business ability, judgment or common sense. But properly designed they will almost automatically supply him with information as to dangers and weak spots. They will show him where excess costs exist and where betterments should be made in order to assure a profit.

In good times the careful executive will make maximum profits by watching his control cost figures, stopping every waste or extravagance at its inception and promoting the sale of his most profitable lines. In bad times he will do the same; but in addition he will doubly scrutinize his product cost and price relationship. If he determines to reduce prices to get more volume, he will do it intelligently in the light of the information which his cost methods provide, so that he will know definitely just what the effect will be on total profits. It is the peak of foolishness to throw overboard the charts and the compass when seas get stormy—something that no skipper would dream of but which far too many business men do, in a panicky effort to lighten ship. The natural result is that they too often end on the rocks.

Here is an example of one company which barely missed being wrecked. Early in 1930, in order to achieve volume sales, it decided to meet all comers as to price, irrespective of cost. Its losses became heavy. At last the directors resolved to go blindly no longer. An analysis was made of the company's facilities, both manufacturing and sales, and the products it was able to produce. It revived and modernized its all-but-dead cost methods. As a result of the

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information brought to light it became apparent that while the company was losing on a large proportion of its sales, it had neglected one practically non-competitive line which was extremely profitable, even in hard times.

Sales effort and promotion were quickly shifted to the profitable items. Although volume was reduced, the company was soon in a break-even position and made a small profit in 1932.

The point I want to emphasize, for experience has shown me that the emphasis is badly needed, is that adequate cost-finding methods maintained at top effectiveness are essential to maximum profits in good times and in bad. When profit margins are narrow, cost knowledge may be the only thing that will enable the business to survive.

In the early days costs were looked upon primarily as a basis for price setting. But it soon became apparent that sometimes business conditions made it impossible to get the price so set. At that point some business men decided that if costs did not always determine selling price, why spend money on them?

We now know that a sound modern accounting and cost-finding method is a multi-edged tool, which can be made useful in many ways. Foremost, perhaps, are the control features. Properly designed, cost methods can be made to give information which will enable the executive to regulate and control every phase of his business which affects profits —and what does not, in one way or another? In fact, to enable management to control labor cost, material cost, manufacturing expense and selling expense in strict keeping with production is one of the most valuable things sound cost methods can do.

So, whether or not a manufacturer feels it to be necessary to use cost figures in pricing his product or to indicate the profit or loss by lines or items, he certainly cannot in good times or bad afford to do without the control features provided by modern accounting and cost methods.

What Sound Methods Will Do

Using to the utmost all of the information gained from sound accounting and cost methods will enable a business to:

1. Definitely determine the true cost of the product.
2. Distinguish between profitable and unprofitable production practices, products, customers, divisions of the business, salesmen or sales agencies, territories and manufacturing and sales policies.
3. Locate points of potential cost betterments by indicating the vulnerable spots.
4. Locate and eliminate losses caused by loose manufacturing and sales practices.
5. Determine the profit reaction to various rates of activity and prices.
6. Intelligently meet competition.
7. Control labor—direct and indirect —material, supplies, manufacturing expense and selling expense.
8. Maintain in all divisions of the business, through a positive cost control, efficient and economical operation after such has been established.
9. Get "value received" for all expenditures.
10. Be guided by current and forceful information.
11. Properly gage and plan the financial requirements.
12. Be more than reasonably assured of a profit.

Timeliness Essential

But to accomplish these things the cost information must be current. Never should it come to the executive less often than monthly. In some cases certain information should be had weekly or even daily, according to the specific need. I know of one concern in a branch of the metal-working industry whose executives every day receive a summary of yesterday's labor costs. It is important information, because in that business a slight rise in labor costs, if not promptly corrected, would spell disaster.

Monthly cost figures are usual today, although not so long ago it was common for the figures to be three or even six months in coming to light. That was hindsight with a vengeance—interesting in a mild way as history, no doubt, but useless as a guide to current profits.

To get accurate, pertinent and concise figures currently does not imply that the methods need be elaborate, complex or expensive to operate. On the contrary, it necessitates their being simplified to the utmost so that only the needed figures will be developed, and they in the easiest, simplest way.

The old time "systems" tended to over-elaboration. I knew of one company fifteen or so years ago which should have made a profit of some $40,000 a year, but which was regularly in the red. Examination disclosed that its elaborate cost methods, of which the management was inordinately proud, were to blame. Not that the figures were misguiding or inadequate. Many kinds of information regarding the business were presented to the executives, and the figures were accurate. The trouble was that more than $40,000 a year was being spent in developing the costs. Simplifying the methods cut the expense of cost-finding about 90 per cent, gave a profit of $36,000 a year and provided the management with more usable information.

In recent years those of us who have been most active in working out cost-finding methods have given much thought to two principal things: simplifying the methods and making the figures as pertinent, condensed and informative as possible.

In the early days of cost-finding, when basic principles were being defined, it was perhaps natural for the science to suffer from too much theory. A theory would be worked out and an attempt made to fit a given business to the theory. There were pet ideas and patent schemes which it was claimed would work for any business. They wouldn't. Adequate cost-finding is not a fine spun theory of accounting. It must be primarily a common sense procedure based on engineering principles. It must reflect the "feel" of the factory and the road in order to show what actually goes on in a business.

Must Fit the Business

The cost methods must be fitted to the individual business. No two businesses are exactly alike, even in the same industry. Thus, while the principles underlying accounting and cost-finding in the metal working industry are the same for all, no two machine shops can safely adopt exactly the same detailed methods, for individual peculiarities will not then be reflected accurately.

The cost-finding methods described in the articles to follow are not theory. They are practical. They have been tested and are in use in many diverse metal-working plants. They must, however, be adapted to the specific requirements of each individual business in order to prove of most value.

They are the engineering type of costs rather than the accounting type. They have been developed by engineers who have actually worked in the various departments, both manufacturing and sales, of many metal-working plants. These engineers have first-hand, intimate knowledge of the proper accounting, controls and product costing which will enable a competent executive to conduct his business profitably.

Not that accounting technique has been neglected. It has been sufficiently and properly interwoven with the engineering so as to produce a simplified, sound and workable method. The aim is to eliminate all the disadvantages and needless elaborations and to incorporate all the advantages at a minimum expenditure of effort.

With the passage of NIRA interest in accounting and cost-finding methods, which had flagged somewhat during the depression, was stimulated.

For one thing, it became evident that rising commodity prices and wage rates made it necessary to refigure product costs and to reflect part, if not all, of the increased cost in the selling price. Business cannot fairly be expected to hold the umbrella.

Then, too, when costs are rising it becomes especially essential to have positive controls over all elements of costs so that they will not get out of hand.

To curb cut-throat competition many codes provide that no one shall sell below cost. All codes should contain such a provision, thoughtful business men agree.

But to know whether a competitor is selling below his cost requires the use of truly uniform accounting and cost-finding methods throughout an industry. At the very outset, the mere suggestion of this divided business men into two camps. One side claims categorically that, "it can't be done."

Distinctions Often Misunderstood

From talking with a number of those who take this attitude I am convinced that their trouble is caused by lack of sufficient knowledge of accounting and cost-finding principles and to a confusion in their minds between "comparable," "standard" and "uniform" costs. Some think they are all the same thing. Some assign to each label whatever meaning they choose. If the distinctions are made clear, much of the opposition to uniform accounting and cost-finding methods will be removed. So here goes:

1. *Comparable* accounting and cost methods provide for identical setups, step by step, in all accounting and cost procedures, so that the results, item by item, of one company may be compared with the same items of any other company in the industry. Even where this is possible, it is seldom if ever wholly practicable and is generally inadvisable.

For example, comparable costs in one industry held a certain company back. Its costs, on comparison with those of others in the industry, proved to be the lowest of all. The management thereupon smugly assumed its operating practices to be perfect and forthwith stopped all efforts toward bettering them. The fact was that this concern enjoyed certain natural advantages which kept its costs low—but there was still plenty of room for improvements which would have put it in an impregnable position.

2. *Standard* costs are neither average nor theoretical costs, to be used by all in an industry regardless of individual peculiarities and conditions. They are, rather, figures for each company based on the performance, using studied good practice, that can be expected in the use of material, labor and overhead at a predetermined rate of production. Standard cost information is usually tardy unless an excessive amount of clerical work is expended. This method is not at all the same as uniform or comparable cost-finding.

3. *Uniform* accounting and cost-finding methods provide for the proper inclusion and allocation of all true financial and cost items by all companies, in a generally uniform fashion, to permit obtaining, through the most direct and simplified procedure, accurate, detailed uniform statements of condition and uniform statements of operation periodically. Though this necessitates that the methods be based upon the same fundamental principles, it is not imperative that the handling of the individual items be identical.

Everyone who has followed the development of accounting procedure during recent years realizes that although there are innumerable ways of keeping the detailed accounts for individual companies, the balance sheets or statements of condition, are now somewhat uniform. It is relatively simple for a given industry to specify with certainty what should properly be included in the detailed accounts and to specify a uniform statement of condition for all members of the industry. Irrespective of whether or not the detailed accounts are kept in the same way in every business of the industry, if all items are properly treated a uniform statement of condition can be prepared which will truly reflect the company's financial status.

Likewise, cost procedure, if it is on a sound basis and includes all proper costs, can differ in detail in individual companies and with little modification can be shaped to produce a uniform operating statement.

Present Systems May Be Retained

One reason some industries have resisted the adoption of uniform methods is because business men felt they would have to throw out the satisfactory methods they have in use in their individual companies, or at least make radical and expensive changes in them in order to achieve uniformity. That is not the case. If a company's present accounting and cost methods are modern and adequate, only minor and usually inexpensive adjustments need to be made.

Another argument against the feasibility of an industry operating under uniform accounting and cost-finding methods is based on difficulties presented by depreciation of plant and equipment. Concerns in direct competition and of about the same size may carry their plants and equipment at very different amounts on their books. One may have, over the years, completely depreciated its plant and equipment. The depreciation charge will therefore be zero. A competitor with a nearly new plant may have to base his depreciation on a plant value of $900,000. Another may have acquired a similar and equally new plant at forced sale for $100,000.

With uniform accounting and cost-finding, particularly under NRA codes, such complications must be taken care of in a way fair to all. Ordinary methods of computing depreciation will not do it. But that need not be an insurmountable obstacle to the use of uniform methods. In a later chapter will be described an unorthodox but practical method for equalizing depreciation.

Uniform accounting and cost-finding methods are generally applicable to all industries and are perfectly suited to the needs of business under the NRA because they not only include every proper cost, but supply control figures and reports which permit direct decision as to whether or not a given company in an industry is selling below cost.

Developed on a source basis, uniform costs gather and disseminate accounting and cost information directly from the sources, doing away with every possible intermediate step. Thus, information required for current control can be had currently without undue expense, and can be acted upon promptly. Modern business requires such controls.

The source basis utilizes predetermined standards against which actual performance is reflected. Only such costs as materially vary from the standard are tabulated in detail. All departments of the business, whether expense or productive, are on a profit and loss basis just as though they were all productive. Few figures are gathered—many pertinent, usable facts are presented. The source basis is the greatest advance in cost control in recent years.

Resistance Baths for Small Tools—*Discussion*

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If A. E. Bellis (*AM*—Vol. 77, p. 302) means that the bath contents form the resistance element, a warning is necessary. When the current flows through the bath, the shape of the work must be considered.

Metal resistance is lower than salt resistance, and a large metal piece may concentrate the current dangerously. Thus, an article, consisting of two large portions joined by a waist of small cross-section, may concentrate nearly all this current if the blocks cover the anodes. I have seen cases where the waist was melted in a medium temperature bath.

Freight Locomotives Use Ground Tooth Gears

G. E. KATZENMEYER
Nuttall Works
Westinghouse Electric & Manufacturing Company

Proper planning of operation sequence and careful maintenance of equipment are essential in the production of precision drives for rigorous railroad service

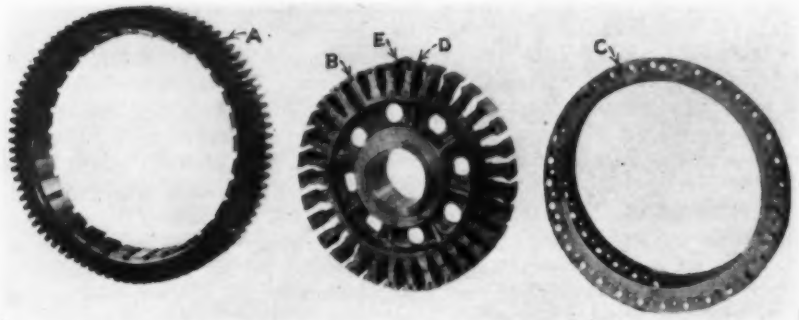


Fig. 1—Flexible gears are built up from: gear ring *A*, center *B*, retaining ring *C*, spring leaves *D*, and spring spacers *E*

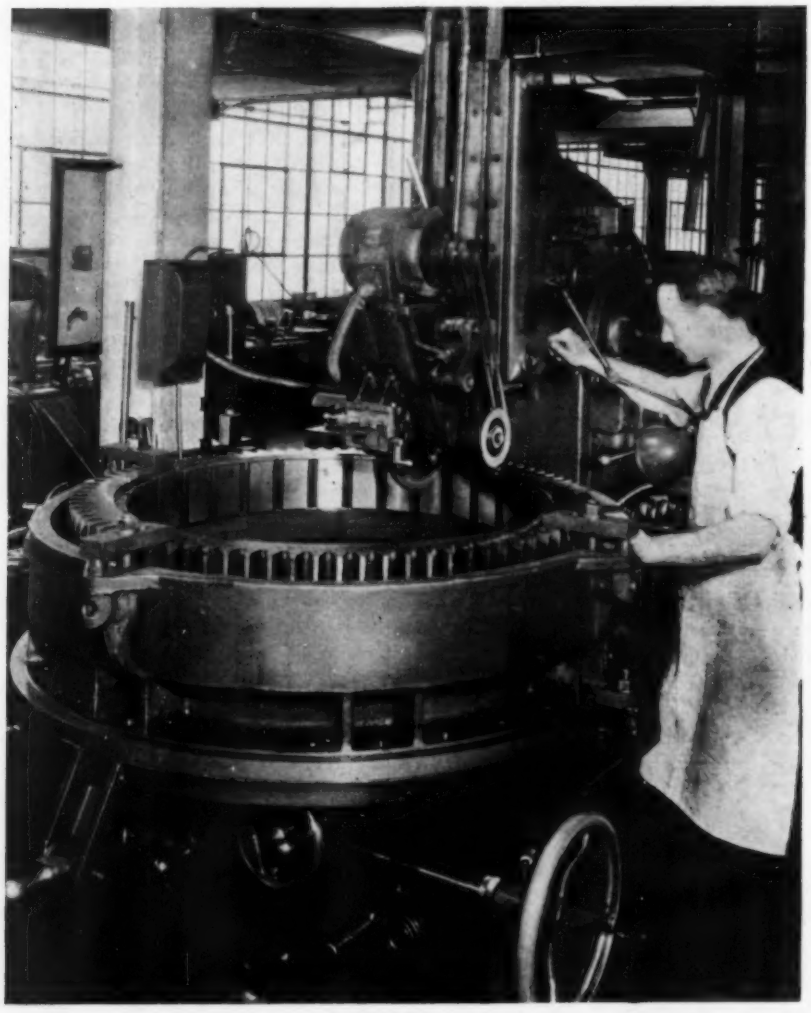


Fig. 2—Slots are cut on a vertical shaper and ground on the same machine by the use of a special grinding attachment

APPLICATION of ground tooth gearing to passenger locomotives in the greatest railroad electrification ever undertaken in America was followed by the application of ground tooth flexible gears for Pennsylvania freight locomotives.

Four pinions and four gears are installed in a 2500 hp. locomotive which is equipped with four single motors having an axle-hung drive and which attains a speed of 54 miles per hour with 62-in. driving wheels. The flexible gear is composed of the following parts: one ring gear, one center, 384 spring leaves, 32 spring spacers, two side plates and 32 rivets as shown in Fig. 1. Gear specifications are: 86 teeth, 1¾ D.P., special form, 6½ face, with a bore of 40.031 in. made from special rolled rings of 0.40-0.50 carbon steel thoroughly annealed.

The gear rings are turned on a 62-in. boring mill leaving stock on the outside diameter, in the counterbore and in the bore. Then the teeth are roughed and finish cut on an 84-in. gear cutting machine leaving stock on for grinding to take care of distortion, warpage and shrinkage. The slots in the bore for the spring members are cut on a 12-in. vertical shaper modified by the addition of a 12-in. block to raise the head of the machine and a special indexing table to accommodate this large gear. Stock is left on the sides of the slots to be ground off after heat-treatment. The rings are heated to proper temperature in a furnace, hardened in a special quenching medium known as "BP" and then drawn in a furnace to the desired hardness of 424-514 Brinell.

The outside diameter, counterbore and bore are ground to the proper size, and the face is touched up so as to make it square with the outside diameter and bore. The grinding of these rings is performed on a reconstructed boring mill equipped with two special grinding heads on which are mounted 12-in. diameter 2½-in. thick Norton grinding wheels of grain and grade 36-J 8-B.

A unique, efficient and highly produc-

tive method for grinding the slots was devised by the attachment of a specially designed grinding head, motor driven, on the ram of the machine used for slotting the rings as shown in Fig. 2. A Norton grinding wheel 13½-in. diameter 1¼-in. thick of grain and grade 38-36-J was used.

The teeth are then rough ground on a 72-in. reconstructed gear cutting machine equipped with a special grinding head with a 16-in. diameter 1¾-in. thick Norton grinding wheel of grain and grade 46-K-5-B. The wheel speed is 5000 ft. per minute with a travel of 16 ft. per minute of the wheel carriage, starting with a feed of 0.004 in. and making final cut with a 0.0005 to 0.001-in. feed.

The magnitude of producing such large gears can be best judged when one considers the shrinkage and distortion of the material of this size and the fact that the teeth of these gears are ground to an accuracy of 0.001 in. tooth to tooth error and accumulative error of 0.0015 in.

The equipment necessary to finish grind the teeth to produce a job such as this would have to be rigidly constructed to withstand any vibration or error which might possibly creep in. The supervision and maintenance on the equipment has to be under the watchful eyes and constant care of experienced men who can readily detect the least trouble that may arise.

Close Tolerances Demand Care

Care of indexing mechanism, formers, proper adjustment of the wheel truing mechanism, the diamonds, mounting of the grinding wheel and gear and the selection of the proper grade of grinding wheels are of most importance in obtaining these exceptionally close tolerances.

The final inspection of each tooth in the gear is made with a standard tooth caliper for thickness and with a normal pitch gage, Fig. 3, for pitch readings.

The center is made from high grade 0.35-0.45 carbon cast steel, thoroughly annealed to obtain the highest physical properties. It is turned on a 42-in. boring mill. The problem of machining the slots in this center was solved by designing an auxiliary cutter spindle head, Fig. 4, to take a cutter large enough in diameter to cut the depth of the slots. This attachment replaced the standard cutter spindle head of an 84-in. gear cutting machine and greatly simplified the production of this part. The drilling operation was performed on a radial drill press.

The retaining rings or side plates were made from 0.040-0.50 carbon rolled steel plate purchased cut to shape with stock in the bore and on the outside diameter. The first operation is drilling four at a time with a jig on a radial drill press;

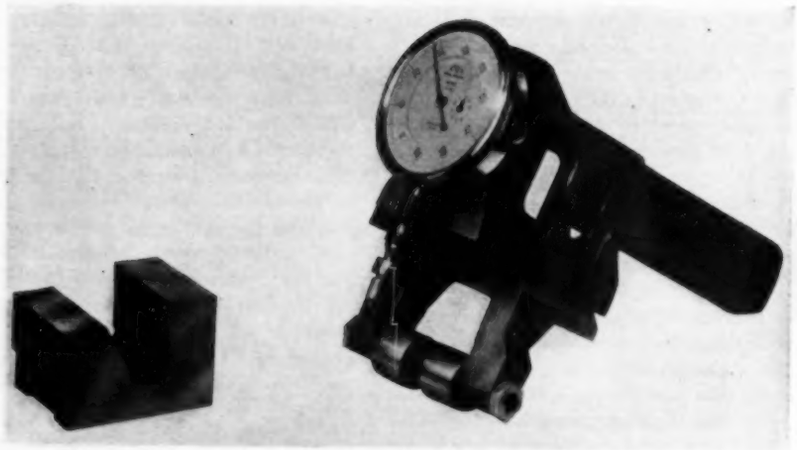


Fig. 3—A normal pitch gage is used as a final check on each tooth

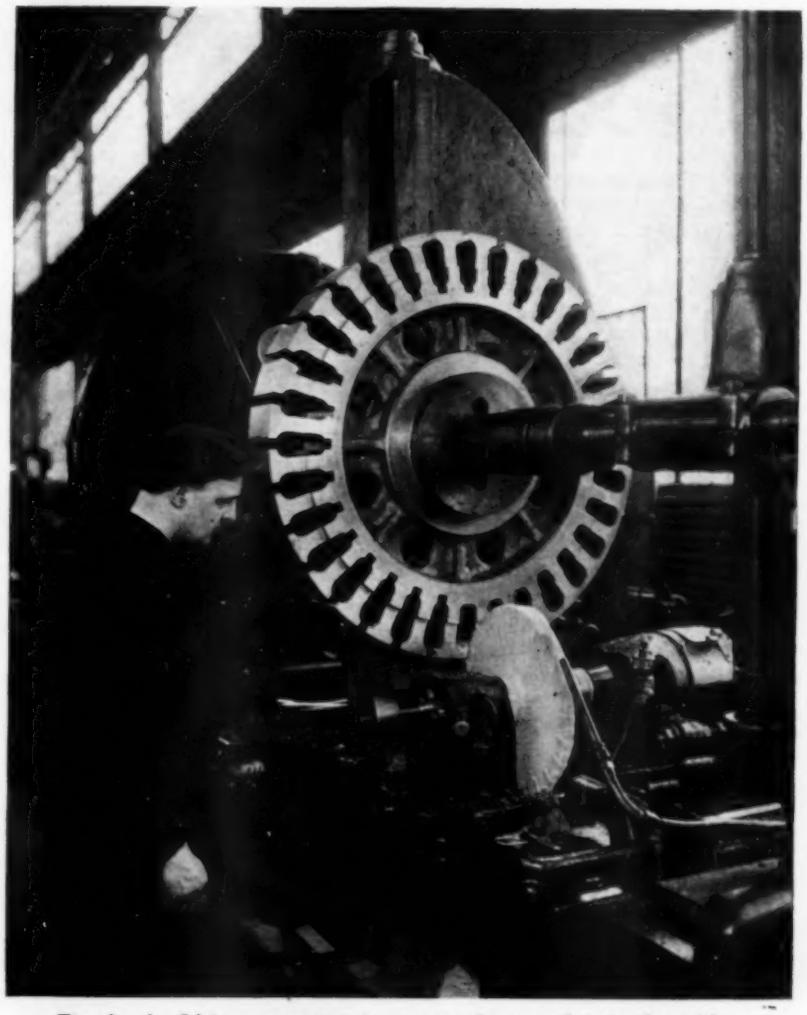


Fig. 4—An 84-in. gear cutter is revamped to cut slots in the spider that forms the gear center

then the rivet holes are countersunk on the same machine. A simple turning fixture was made using four of the drilled holes in the plates for clamping and driving while turning the outside diameter and the bore of four pieces at one time on a 42-in. boring mill. After turning, the side plates are sent to the heat-treating department for an oil treatment to 260 Brinell and are then sand-blasted to remove all scale.

The spring leaves, 2⅝-in. wide, ⅛-in. thick and 6½-in. long, are made from a select grade of chrome-vanadium steel, cold rolled as nearly perfectly flat as is possible with the best rolling practice. The leaves are sawed (not sheared) to length, heated slowly and uniformly to a

certain degree of temperature in a furnace, held for sufficient length of time to insure complete heat penetration and then quenched in oil and allowed to cool to approximately 200° F. The leaves are then drawn in a salt bath for a period of time and immersed in water to obtain the following physical characteristics:

Proportional limit (min.) lb. per sq.in. 170,000
Brinell hardness ..... 387 to 425
Endurance test in reverse bending lb. per sq.in. 89,000
Deflection test ..... 0.221 in. at the middle of 5¾-in. length.

The spring spacers are made from 0.15-0.25 carbon rolled flat bars milled to shape, sent to the heat-treat department, carburized and quenched in oil to obtain a hardness of 70 scleroscope and then sand-blasted for the removal of all scale.

All the parts are sent to the assembling department for assembling in complete gears. A special fixture with a riveting hammer attached was made for facilitating this work. First, one of the side plates is laid on the fixture, then the ring gear and center. The spring leaves and spacers are inserted in the slots and then covered with the other side plate. Several clamping bolts are used to hold all members in place while the riveting operation is performed.

The mating pinions of 20 teeth, 1¾ D.P., 6½-in. face, made from the same material specification as the gear and held to the same tolerances, are ground on a 24-in. tooth grinding machine. The wheel used for grinding the teeth in the pinions is a Norton, 14-in. diameter 1¾ in. thick, of grain and grade 3846-J operated at a speed of 5000 ft. per minute. The wheel carriage travels at approximately 20 ft. per min. The grinding feed starts at 0.004 in. feed per min. and the final cut is taken at 0.001 in. per min.

Cemented Carbide Cutting Tools—*Discussion*

ROBERT COREY DEALE

Despite the tremendous volume of literature covering cemented carbide metal cutting tools, little quantitative data are available. To the best of my remembrance, the only other data, gathered in a thoroughly scientific manner, were those presented by T. G. Digges, of the United States Bureau of Standards, in "Cutting Tests with Cemented Tungsten Carbide Lathe Tools," presented before the A.S.M.E.

I have compared the data presented by Malcolm F. Judkins and William C. Uecker (*AM*—Vol. 77, pages 325 and 364) with that reported by Mr. Digges, and have found various discrepancies. However, I believe that these would tend to disappear, if the two sets of data were figured on the same basis. One important difference relates to the method of measuring cutting speeds. Mr. Digges conformed to the practice of the Bureau of Standards in its other work on the cutting of metals and measured cutting speeds at the bottom of the cut. Mr. Judkins and Mr. Uecker, on the other hand, conformed to the practice set by F. W. Taylor, as reported in "The Art of Cutting Metal," and measured cutting speeds ahead of the tool, on the large diameter of the log. It is believed that this method conforms more closely to usual shop practice in the United States than the method used by the Bureau of Standards, although either method would be satisfactory if it were not desirable to compare results.

Standardization in the methods used in metal cutting research work is desirable to promote direct comparison of results. It is probable that this could not be carried far, for the present at least, but to my way of thinking, there is no reason why a simple code could not be drawn up for the guidance of those proposing to undertake additional work in this field. As matters now stand, no direct comparison is possible between the three greatest sets of experiments on the cutting of metals that have been published in English, because of the difference in which the cutting speed was measured. These include Taylor's classic work, the Manchester experiments, in England, and the valuable work that has been carried on at the United States Bureau of Standards. In no two were the same methods adopted.

I regret that Mr. Judkins and Mr. Uecker used tools so nearly of the same size as those used by Mr. Digges. I have recently analyzed all metal cutting data that are available and have come to the conclusion that tool size is an important factor in determining the speed with which a given cut may be taken with high-speed steel tools. It seems probable that there is similar relationship for carbide tools, although in the case of such tools there is the question as to whether tip or shank size would be the controlling factor.

If the authors carry the work further, it will be of particular value to determine the effect of tool size, feed, depth of cut and tool shape and cutting speeds for the various materials used regularly in the construction of machinery. Inasmuch as tungsten carbide tools appear to have particular value in the cutting of cast iron, I believe test results on the turning of cast iron with carbide tools would be of value.

Gasket Cutting and Punching

CHESTER H. FRANKLIN

The cost of cutting gaskets for air pumps and joints of various kinds, has been materially reduced at the Battle Creek shops of the Grand Truck Western Railway by the use of the machine shown in Fig. 1. This machine has a welded stand or base, and the frame of the machine itself is made from T-shaped steel as can be seen. The upper arm is reinforced by an arch with a strut in the center.

Cutting is done between two revolving knives, the upper knife being driven on the horizontal shaft shown. A friction disk on the back end of this shaft permits a wide variation in cutter speed by varying the position of the driving roller behind the disk. Power is obtained from the small motor shown behind the round gasket, the motor being belted to a horizontal shaft. The position of the driving roller is adjusted by the hand wheel shown at the back. The gaskets shown give a good idea of the variety of work handled on this machine.

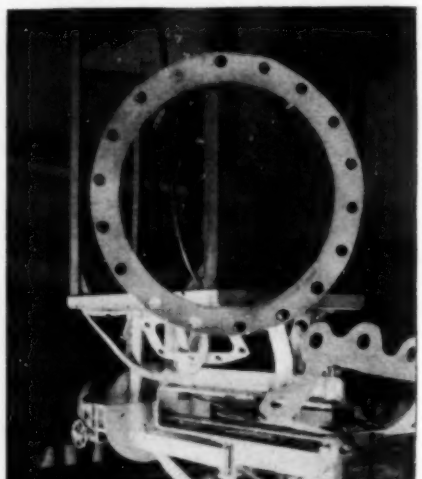


Fig. 1 — Gasket cutting machine built up from shapes and plates

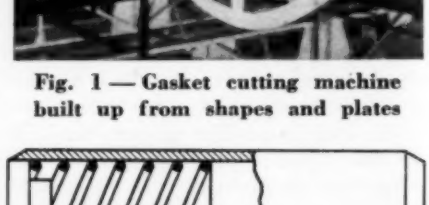


Fig. 2—Bolt hole cutter with a stripper for ejecting disk

Punching the bolt holes is made easier by using a special punch made with a stripper inside as seen in Fig. 2. Such a punch can be easily made from a steel tube with the cutting end hardened. Inside the tube is a block to back up the spring and a disk which acts as a stripper and forces out the piece cut from the gasket. This is not only a convenience but it saves time as well.

Voltage Variation:

Its Effect in the Shop

A. W. FORBES
FORBES & MYERS

WHEN a shop purchases electric current at 220 volts, many people think that it will always be found just 220 volts. As a matter of fact, it is seldom desirable to keep the voltage exactly right, and if it were desirable, it would not be practical. In some shops, when the machines are stopped, the meter may read 240 volts, but when all are running, it may drop to 220 volts. In other shops, the voltage may be 220 volts when the machines are stopped and only drop to 217 or 218 volts when fully loaded. In practical experience, we find plants with the current at all points between 200 and 250 volts, and still it is rated 220.

Consider a small shop or a department of a large plant which requires 100 amp. on full load and which gets this current from a large power system through a transformer. Assuming that the voltage remains practically constant on the large power system, there is still a drop in voltage in the transformer and a drop in the wires from the system to the machines in the shop. It is possible to install a transformer with but little drop in voltage and to use large wires. Or we can use a transformer with high reactance and as small wires as will carry the current. In the first case, there will be little difference in voltage between no load and full load. In the second case, there will be a considerable drop.

In the first case, there may be a drop of 1 per cent on a 100-amp. load. Suppose now that through a defect in some switch or elsewhere a short circuit occurred. On short circuit, the voltage drops to zero or 100 per cent drop. That permits nearly 100 times as much current to flow as with a 1 per cent drop or approximately 10,000 amp., enough to make a destructive spark. It will probably wreck the switch and may start a fire. It is true that the system should be protected by breakers or fuses, but before the fuses have time to blow, considerable damage may be done.

If, instead of trying to keep the voltage constant, the transformer and wiring are such that the voltage would drop 20 per cent as the load comes on, there would have been only five times the full load current on short circuit or 500 amp. This will make quite a flash and make people jump, but it is not likely to do serious damage before the fuses blow.

To express this in a different way, a circuit carrying a large amount of power is more dangerous than one carrying only a little, and it must therefore be more carefully protected. The circuit with nearly a constant voltage acts like a circuit of larger power, and consequently needs better protection.

In practice no attempt is made to control the voltage within 1 per cent nor is it allowed to drop 20 per cent. Actual conditions will be found somewhere in between. It is possible to install a system with nearly constant voltage, but without the heavy short circuit current. To do this a transformer is used that permits a large drop in voltage, but this is compensated by a condenser at each machine. As each machine is started, the motor would cause a drop in voltage, but at the same time the condenser would cause a rise in voltage, the two neutralizing each other. This system also has the advantage of producing a high power factor and should be used more.

We will next consider what happens to the motors when the voltage is high or low. With a uniform load, each motor being properly selected for its job, there is practically no effect. A standard motor will operate almost equally well on any voltage from 10 per cent low to 10 per cent high. As the voltage drops, the current will rise to balance, and the watts will be the same. However, the increase in current on low voltage will make necessary a somewhat larger wiring throughout the shop.

In practice this condition is seldom met. Motors may not be fully loaded, or there may be motors of unusual design such as for slow speeds. Or there may be other forms of load than motors; lights, heaters, etc. Or large momentary overloads may be met. All of these upset the conditions stated in the last paragraph.

With such machines as snagging grinders, circular saws and portable tools, the rated power output is not usually an important factor. A motor is required that will give 3 hp. for five seconds, and it is found that a standard 2 hp.-motor will do this. But the maximum power is different from the rated power in that the capacity of the motor is proportional to the square of the voltage. If the voltage drops 10 per cent the maximum power drops 19 per cent so that the motor will now only give 2½ hp. in place of the 3 hp. that is required—quite a serious item. With the voltage 10 per cent low, every drive of this nature must have a size larger motor.

With motors that are not fully loaded, there is a distinct gain in a lower voltage. The efficiency of any motor of standard design is better at full load than at half load, and the power factor is also better. Drop the voltage, and it decreases the size of the motor, increases the efficiency, and reduces the current required. It seems like a gain all around. But the same result could have been secured by using a smaller motor. If the oversize motor was installed by a mistake in judgment, the natural remedy would be to change the motor. If it was installed so as to have a reserve capacity in case of need, dropping the voltage has reduced the reserve capacity. The apparent saving in current by dropping the voltage is not a sound saving.

Slow-Speed Motors Differ

Motors for slow speeds or small sizes differ a little from standard motors in their action. In both cases, the larger part of the current is used to magnetize the iron. So, quite regardless of the load, a drop in voltage results in less magnetization and a lower current input But like the standard motor, the maximum power is reduced in proportion to the square of the voltage. In these motors, the maximum power and the rated power are often quite close to each other, so a drop in voltage may reduce the maximum power below the rated power.

And finally there is the question of speed. If we take a motor of synchronous speed of 1800 r.p.m. and full load speed of 1770 r.p.m. a drop in voltage of 10 per cent will drop the full load speed to about 1763 r.p.m., while the no load speed remains the same at 1800 r.p.m. But if the motor is one with large slip, so that if run at 1700 r.p.m. the speed on 10 per cent low voltage would make a greater difference, and would come to about 1675 r.p.m.

Multi-Blade Cutting Tools

Their Design and Use—V

R. R. WEDDELL
The O. K. Tool Company

With a description of hollow mills the author concludes his five-part series

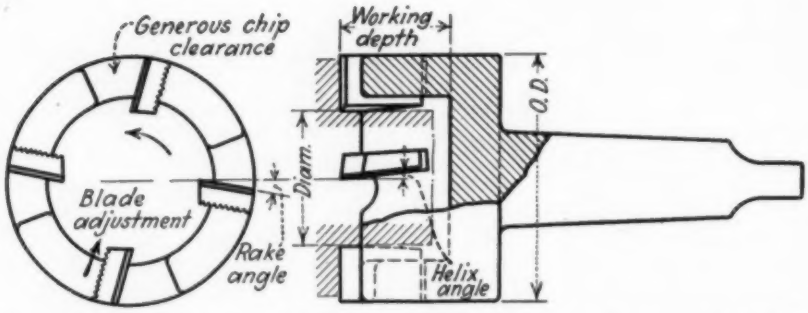


Fig. 1—Chip clearance, rake and helix angles are shown for a typical mill

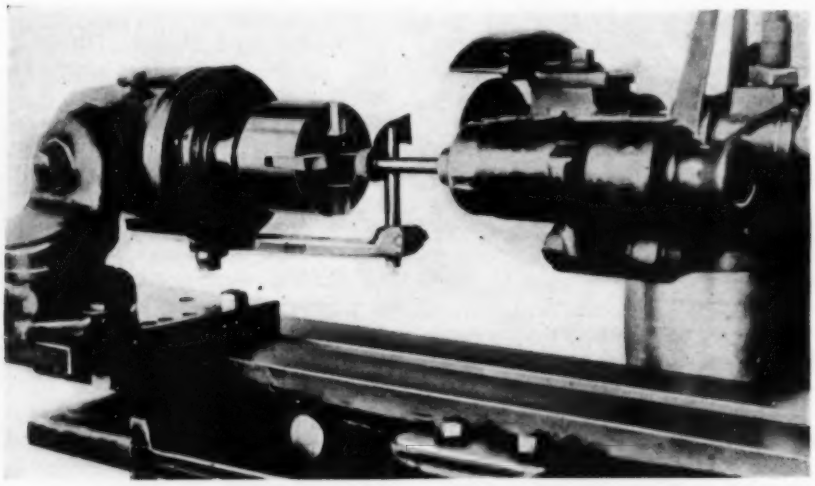


Fig. 2—A universal grinder with internal attachment is set up for sharpening hollow mill blades

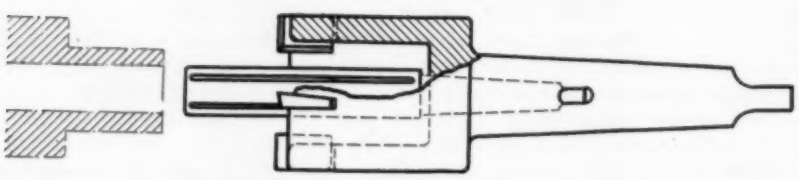


Fig. 4—A pilot located in the hollow is sometimes useful to steady the cut

HOLLOW mills are boring heads turned inside out and are used for milling bosses or projections. They are multi-blade tools which supplant the usual single-point box tools.

As shown in Fig. 1, all considerations of cutting angles are reversed as compared with boring cutters. While the cutter blades must have rake, the slant of the blade is opposite. The rake angle pushes the chip away from the center and prevents clogging. Since rake reduces the body strength, small cutters are often used without it. A slight helix angle is generally incorporated when using inserted blades. This, too, is necessarily omitted on the smaller cutters. The outline of the blade is similar to that of a boring head, except that it generally has a sharp corner. The blade, after short straight tip, is relieved on its inside edge.

Many types of inserted blade hollow mills are offered commercially. They include types in which all of the blades may be unlocked and moved inward together and those in which the blades are removed separately, reinserted and reground to size. The former type is somewhat simpler to maintain as the blades may be reground when off the cutter. For all real accurate work, however, the blades must be ground after adjustment and lock-up in the cutter.

The grinding operation is rather unusual. The cutting edges are ground by using an internal grinding attachment on a universal tool grinder. The cutter is mounted in the conventional manner, shown in Fig. 2, in the universal work head adjusted to obtain adequate clearance. The periphery of the internal grinding wheel backs off the blades. The wheel should be as large in diameter as practical without interfering with the next blade. The outline angles are further shown in Fig. 3.

While a hollow mill is a reversed boring head, during the major portion of its cut, at the finish of the operation it generally faces a shoulder of some sort. Fewer blades are required for facing. Also the number of blades is limited, as they interfere with grinding, as shown in Fig. 3. Three, four or six blades are

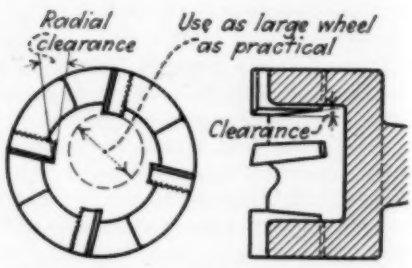


Fig. 3—Strength of the body and wheel clearance limit the number of blades it is practical to use

sufficient. With these few blades, compared to the typical single-point tool for this operation, there is a proportional increase in production.

If there is no excessive stock to be removed, the cutting speeds and feeds for hollow milling, roughing or finishing, are identical to those for boring, although the feed should be reduced at the end of the cut during the facing operation. Roughing cuts in hollow milling refer to cuts taking about ⅛ in. on the side and finishing to about $\frac{3}{32}$ in. on a side. The feeds are about 0.010 in. per blade, the same as for boring tools.

Body designs of hollow mills have the same range as boring tools. They may be of the solid shank type, as in Fig. 1, which may be made to guide itself by grinding its outside diameter to locate in a piloting bushing or a separate pilot may be fitted within the tool to guide it in a previously bored hole, as shown in Fig. 4. Larger hollow mills are best made of the shell type, that is, with bore, and are located on a separate arbor.

Attachment for Scarfing Pipe

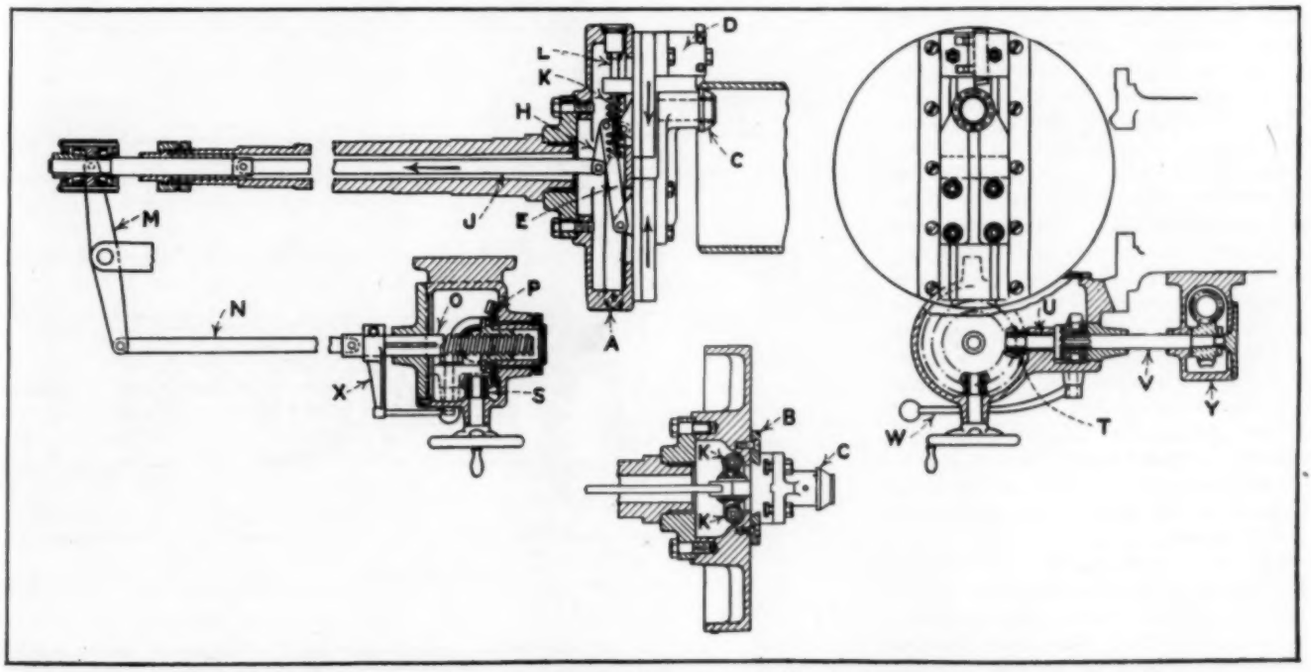
A. L. HARTLEY

To obtain the best welded pipe-joints, the pipe should be scarfed or chamfered at the ends. As pipe is always more or less out of round, scarfing in a lathe in the usual way would result in a chamfer that was not uniform and not at all satisfactory. To eliminate this condition, the attachment illustrated was designed, in which the out of roundness of the pipe is cared for.

The chuck-like body *A* is mounted on the spindle nose of the lathe and the dovetail *B* is fitted with two slides carrying the follower roller *C* and the toolblock *D*. Both of these units are held in alignment on their respective slides by tongues and grooves and are clamped thereon by bolts engaging T-slots. By this construction the roller and the toolblock can be independently adjusted for pipe of different diameter and thickness. The slides are linked together by the links *E* and *H*. Link *H* is connected directly to the tool slide and indirectly to the roller slide by the intermediate link *E*. The drawbar *J* is connected to the link *H*. When the drawbar is moved in the direction of the arrow, the tool slide and the roller slide are moved toward each other, as indicated by the arrows on the slides.

However, since the drawbar is a pivoted link and both the roller slide and the tool slide are free to move in unison, both the tool and the roller will follow the contour of the inside of the pipe. Since the drawbar and the links prevent the slides from moving independently, they must move in unison, their movement being controlled by the roller bearing against the inside of the pipe. Thus the chamfer will be uniform regardless of the out of roundness of the pipe. Two coil springs *K* force a lug on the tool slide against the positive stop *L* when the drawbar is in the forward position. The linked connection between the two slides causes the roller slide to be held in position. This construction permits work to be loaded without bothering to position the two slides at each loading, as would be necessary if the springs were omitted.

The feeding mechanism illustrated can be applied to any engine lathe of sufficient capacity and has many advantages over a simplified hand feed. An extension of the drawbar is mounted in the rear end of the spindle and is held in alignment by a long sleeve. It is actuated by a roller-bearing shoe that engages the yoke *M*. The opposite end of the yoke is connected to the rod *N*, which in turn is connected to the screw *O*. The screw is supported in a housing carrying the bevel gear *P* and the two bevel pinions *S* and *T*. The bevel gear is bushed with a bronze nut for actuating the screw *O*. Pinion *S* engages the bevel gear and is rotated by the handwheel shown. Pinion *T* is mounted on the shaft *U* carrying one member of the clutch. The other member of the clutch is mounted on the end of the spline shaft *V*. The clutch is engaged by the lever *W* and is automatically tripped by the adjustable dog *X* on the screw *O*. The opposite end of the spline shaft carries a bronze wormwheel that meshes with a worm mounted on the regular feed rod of the lathe. The wormwheel assembly is mounted in the casting *Y*, which fits on the lathe bed. The pipe to be chamfered is held in position by two regular streadyrests equipped with serrated jaws of steel.



Pipe for welded joints is chamfered uniformly by means of this feeding mechanism for the lathe

Two Types of Sub-Press Follow Dies

JOHN C. DENSE

THE follow dies described are of the type in which the part is carried along in the strip until it is completed, all the necessary operations such as shearing, drawing, squaring, perforating and blanking being done. Such dies are expensive and are not used except on quantity production. In considering their economic feasibility, the following factors must be known: parts quota for a year; cost of follow dies; cost of separate dies for each operation; and labor savings of follow dies over separate dies.

Either a hand or a roll feed may be used to operate follow dies. Fig. 1 shows a die designed for a small brass cup with a narrow flange and a small hole pierced in the center of the cup. Main components of the die are the die shoe, punch holder, four guide posts and the ejector plate *A*. The punch holder is returned by four springs, *B*, and is operated by a punch plate *C*, through two plugs *D*. Ejection of the blank is performed by pins *E*, which strike the underside of the ejector plate on the upstroke. The first operation is shearing two circular segments from the stock, leaving only enough at the sides to hold the blank. The second operation is the first draw, while the third takes care of the squaring and finish draw. At the fourth operation the center hole is pierced, and the slug is carried up into the punch holder in a tube and out through the back. This slug might be ejected by a positive knockout, but there is the possibility of its falling back onto the stripper plate and causing trouble. At the fifth and last operation the cup is blanked out and ejected from the blanking ring by a positive knockout. The stripper plate *F* is operated by stripper springs and pad screws, not shown. At *G* is a stock stop pin which is not used when the die is operated with a roll feed. A section of the stock, after being put through the die, is shown at the top of Fig. 1, illustrating how it pulls in at the sides because of the tiebars that are left in at the shearing operation.

In some respects the die shown in Fig. 2 is similar to that shown in Fig. 1, but in place of the four springs actuating the punch holder it is actuated by pins and crossbars operated by a spring-pressure device *A* underneath the punch

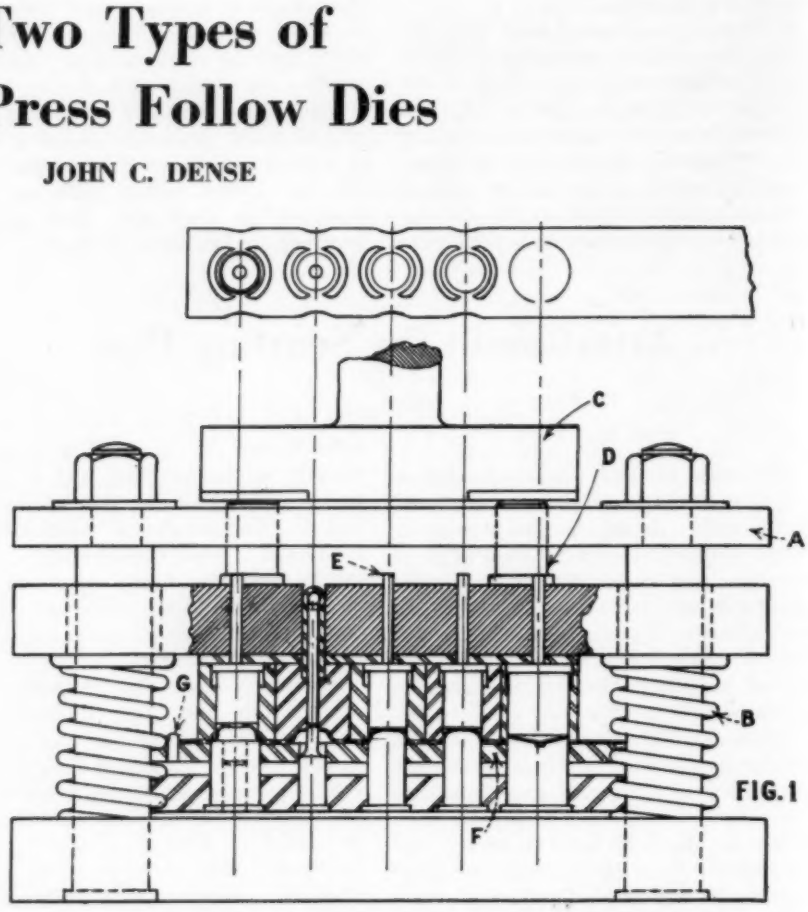


Fig. 1—This five-station follow die produces a small brass cup with a narrow flange and a small hole perforated in the center of the cup. The cup is carried along in the strip until completed

Fig. 2—At the fifth station the cup is blanked, then pushed back into the stock by spring B so that it is carried along to the last station where the flange is ironed down

press bed. The first station in this die is similar to that of Fig. 1. The second station is also somewhat similar but draws a dimple in the center of the cup. This dimple is gradually reduced until in the fourth station the dimple is squared up into a dowel. At the fifth station the cup is blanked from the stock and pushed back into the stock again by the spring *B* so that it can be carried along to the sixth station where the flange is ironed down into a straight skirt. Wrinkling of the blank is prevented by a spring pad *C*, and the blank is carried up in the draw ring and ejected by a knockout pin.

In the construction of these dies the die blocks, draw rings, shearing rings, blanking rings and other parts are separate blocks fitted together and screwed and doweled to the punch holder with a hardened plate to back up the knockout pads which bottom on this plate. The shearing punch, draw punch, and blanking punch are held in a punch plate and are backed up by a hardened plate, which is screwed and doweled to the die block.

Repair Work—Who Should Do It?

Discussion

R. S. ALEXANDER

In the timely editorial under the above heading, we are confronted with a problem which is perplexing executive minds all over the country, as industry shows signs of rousing from the lethargy of the past few years.

Yet I cannot agree, as the article would suggest, that the problem is confined to the non-metal working industry alone. I know of metal working concerns—equipped with the machine tools to handle repair work—who find it cheaper to send their repair work out than to maintain a repair force or release skilled machinists from production work to handle repairs. Particularly is this true in the jewelry industry, where small independent machine shops exist solely on the repair work from four or five manufacturing concerns. Incidentally, those repair shops are among the best equipped and most efficient in the country—they have to be, in order to render profitably the service that is expected of them.

In the main, however, as the editorial indicates, the industries vitally concerned with this aspect of the repair problem, are the textile, shoe, printing, and allied producers who do not possess, as production equipment, machine tools. They are—and have been—attacking this question of repair and maintenance overhead so vigorously that even the past decade has produced some significant results. The trend of these results has been in the direction of skeletonizing the machine shop force in the plant and neglecting to renew worn-out machine tools, because of a dawning awareness of the fact that outside repair work—apart from a sudden emergency—imposes a lesser burden on overhead. It might be well to look at the cause, or causes, of this gradual dissent from the once accepted practice of depending upon the plant machine shop, no better example of which can be found than in the textile industry.

The average textile mill is dependent for successful operation, on a plentiful water supply. In order to obtain this as cheaply as possible, it was and is the custom—one might say a necessity—to have the mill situated quite a distance from the nearest city. Which also meant, in less modern days, that they were faced with the necessity of generating their own power to drive the machinery. The machinery and power plant of other days was not so dependable as that of today, therefore it required a fairly large and competent machine shop force to keep it running. It might be said in passing that from these mill machine shops there have come many able mechanics and inventors who have written their names large in the industrial history of this country. Gradually, however, the large power corporations spread their network over the most remote parts of the country and the mill power plant became expensive, therefore obsolete. Hand-in-hand with cheaper power, came other improvements; slowly but surely the mill machinist became less of a "trouble shooter" and more concerned with routine, inspection, lubrication, etc., and just as surely the machine shop force became a target for mill economy campaigns—and the end is not yet in sight. The master mechanic of today has less occasion to fear a possible breakdown than his predecessor of thirty years ago—the telephone, automobile, and even the airplane are his for speedy part replacement at the minimum of cost. Why then retain a skilled machine shop force and maintain expensive tools for an occasional minor repair?

JOHN CLAYTON

During slack periods, in order to find jobs to keep at least a skeleton organization together, overhauling work frequently is attempted in the shops of machine tool users, for which there is available neither the necessary special equipment nor specialized experience, with the result that considerably more money is paid out for a vastly inferior job, than if the machine or component units were returned to the maker's shop for reconditioning.

On the other hand, when these users are busy on their own work, some of them have been surprisingly resentful if they could not get such jobs done promptly in the shop of the maker of the machine. They completely ignore the fact that these rush repairs would prevent his keeping his delivery promises on new machines during one of those all too infrequent and short periods when there is any demand for his product and all his customers want to be served at once.

Machine tool users might well give thought right now to the desirability of sending such important overhauling work to the makers of the machines, in whose shops it can be done best and at a time when it can be done most advantageously all around. In this manner, the user will foster his source of supply, so that it will be available when he needs it urgently, and his equipment will be made ready to take full and immediate advantage of any pick up in business.

JOHN MARK MAY

Industrial plants are often located so far distant from a jobbing shop large enough to have the variety of tool equipment adaptable for doing their repair work, that they are compelled to equip themselves with more tools and maintain a larger repair gang than would otherwise be necessary, thus assuming an expense out of proportion to the repairs made.

Wherever the factory is within a reasonable distance from a well-equipped jobbing shop, the repairs needed in the factory can be more efficiently made in the jobbing shop as regards cost, time and quality because a larger variety of material is available and the class of work involved is being done in greater volume and performed by men who are especially trained in such work. It is generally conceded that most of the men who are apt in quick changes from one kind of work to another gravitate to jobbing shops.

Factories, of course, require men well versed in setting up and adjusting their machines and making replacements of spare parts made by the machinery

manufacturers including those parts that wear out or break frequently. Such parts should be kept on hand as they can be installed profitably by the factory mechanic. As they install more and more standardized machines for which repair parts are readily available, plants become less dependent on repair shops—their own or outside ones.

GILBERT G. COOMBS

In any discussion of plant repair shop versus contract shop, it should be realized that the number and nature of the factors involved makes every plant a special case, to be judged on its individual merits. Considering these factors in order of importance, the first thought is the quantity of repair work which will be required. Experience with the type of plant under consideration is essential, and will assist in determining if the work is sufficient to consider further the installation of a repair department, and will also determine the size of shop required, type of equipment and approximate number of mechanics. While the initial cost of the installation can be closely estimated and the operating cost approximated, it will be difficult, if not impossible, to estimate the cost of repairs for a given period if the work be given to a contract shop. In fact, a comparison of the cost of repairs by the two methods is extremely difficult, and here again experience with the equipment under consideration becomes invaluable and will usually definitely indicate the procedure to be followed.

If immediate service on breakdowns is of vital importance to the operation of the plant—and it usually is—this factor should be carefully considered. The size of the available contract shop and its location with respect to the plant are matters which will affect this phase of the problem. During the better trade periods, such as we hope lie ahead, it is not unusual for a small shop to have every employee engaged on various rush jobs which simply cannot be dropped, and while the same condition may prevail in the plant repair shop, help can usually be drawn from other departments.

The question naturally arises as to which plan will produce the most efficient work. Generally speaking, the contract shop is far better equipped for all-around repair work, but it should be borne in mind that the plant repair shop can be built around the actual requirements of the plant, and if care, forethought and experience have their part in the selection of equipment, jobs which cannot be efficiently handled will be few and far between. With regard to workmanship, it would appear that the worker in the plant shop has some advantage since he is continuously employed on one class of work, and becomes in time somewhat of a specialist. The contract shop mechanic on the other hand, works today on a printing press, a bottling machine tomorrow, and anything that comes his way thereafter. He is to be congratulated on the wide experience he is gaining, but his work on the bottling machine certainly fails to make him expert at repairing printing presses, and vice versa.

The contract shop offers some advantage through this varied experience, however, for with it is acquired knowledge of the most up-to-date shop practices. In an almost unlimited range of repair work and daily contact with various mechanical executives lies an education of considerable value to the shop supervisor and his clients.

Perhaps the strongest argument against the installation of the plant repair shop is the fact that the supply of work is notoriously spasmodic, and unless this evil can be safely guarded against, it becomes a serious obstacle. Contract shops are faced with this identical condition, and can do little to remedy the situation, since every job which comes in must be completed in a reasonable time. The plant shop, however, is not so handicapped and by careful supervision and planning can accumulate a supply of work which will keep its staff busy in the absence of emergency repair work.

The writer has had a number of years of experience with contract shops and as manager of plant repair shops, and believes that if the foregoing factors are considered and fail to disclose any serious objection, the plant repair shop will prove to be the most satisfactory, efficient and economical answer to the problem.

Inspection and Temporary Gages

C. E. SCHIRMER

Chief Engineer,
Hoist & Crane Division, Robbins & Myers Sales, Inc.

In some shops the importance of proper inspection of parts produced is not given the emphasis it deserves. In many cases no inspection is made between the several operations through which a piece must pass, so that labor is often performed upon it after it has become defective, either because of flaws in the material, or because of being incorrectly machined. The inspector should be supplied with proper checking fixtures and gages. Too often he must depend upon his own small collection of tools to check measurements. Simple inexpensive gages usually pay for themselves even on small production lots. The toolroom can frequently reduce the cost of such tools or gages by eliminating refinements if it is informed regarding the quantity of parts to be inspected. In many cases there is not enough cooperation between the production department and toolroom.

The average toolroom has the habit of using the same kind of material and finish for a temporary or comparatively little used gage as for high production equipment. Good judgment must be exercised to determine the dividing line. Decision as to quality should be made only after all facts relating to quantities to be produced and the possibility of changes in design are carefully considered.

The cost of tools, fixtures and gages may be reduced materially by taking advantage of acetylene gas cutting torches. Some of these can cut through a foot of steel with great accuracy and leave an edge as smooth as though it had been cast. This permits the use of rolled steel in place of cast iron, or even cast steel, at a lower cost and with higher strength and greater dependability.

Making Contour Forming Tools Without Calculations
Discussion

WM. S. ROWELL

Thanks to Charles Kugler for explanations (*AM*—Vol. 77, page 350) of his methods of making form tools as described in his article under the title given above (Vol. 76, page 1138). The explanations show that the tool was used for *boring* the outer race, while the language in his original article, "for *turning* the inner race," gives a different impression and accounts for my statement (Vol. 77, page 25) that any part of the cutting edge that acted above the center would lack clearance and would refuse to cut.

Used as a boring tool, conditions are reversed, as cutting above the center gives increased clearance. A tool made from Mr. Kugler's templets might be expected to give a close approximation to the correct form of cutter, providing the templets were cut from annular ring (rod) and annular tube of the same diameter as the race on the line of cutting contact.

If C. A. Johnson will kindly agree to do the necessary calculating for such a tool and point out the difference between Mr. Kugler's templet-made tool and one made to his calculations, he will confer a favor on interested readers. Of course, Mr. Kugler will have to furnish much detailed data.

Piston Rivets—In and Out

FRANK C. HUDSON

Locomotive pistons with their cast steel centers and bull rings that are riveted in place, present something of a problem. The shop men of the Grand Trunk Western Railway at Battle Creek, Mich., have worked out a method of handling that saves both time and a lot of hard work.

The riveting of the heads in place is done quickly and easily in the short gap riveter seen in Fig. 1. This riveter is housed in a concrete pit beneath the shop floor, and when not in use, is covered over with planking that is flush with the floor. When bull rings are to be riveted to piston heads a portable electric rivet heater is wheeled beside the pit. A piston head and rod with the bull ring attached temporarily by three or four bolts is lowered so that the piston rod rests on the supporting rollers *A* at the left, and everything is ready to go.

The rivet heater puts a rivet in the first hole, the riveter rolls the piston down into riveting position and operates a valve that first moves the arm *B* against the piston forcing the rivet against the hold-back *C*. The same valve then admits air to the riveting cylinder and the ram closes on the rivet and heads it in place. Just behind *B* is a flattened projection that goes into the ring groove and moves the piston forward to clear the hold-back while it is being turned. As the rivets approach the first bolt this is removed without in any way delaying the operation. Inserting 20 rivets in 7 min. is an everyday performance. Fig. 2 shows the piston in position.

When bull rings must be replaced the removal of the old rivets is frequently a task for a husky sledge swinger, plus a helper to hold the punch in place. Here one man does the job with ease and dispatch. The rivet heads must of course be burnt or cut off in either case, burning being used in this shop.

The piston head and rod are lowered in position as shown in Fig. 3, resting on four rollers as in the riveting operation, and a perforated guard is dropped over the back end to prevent rivets from flying and causing injury or damage. In addition to this there is a substantial elbow placed just behind the rivet being driven out to deflect it to the floor beneath the guard. With the piston head rolled into line with the punch of the air hammer, air is admitted to the cylinder below the hammer, which has a ram that forces the piston back against an anvil. Then the air hammer comes into play and the rivets are driven out.

Another interesting feature, and one that plays an important part, is the way in which these pistons and rods are handled. A special clamp has been made, as in Fig. 4, which is of ingenious design. The jaws go around the bull ring and the pull of the crane on the upper lever locks the clamp as long as the load is on it. The special feature of the clamp is the arrangement of the notches for the lifting ring at *A*. These notches are so spaced that with the ring in its proper notch, the piston and rod will hang level. Each notch is marked for a different size of piston, or class of locomotive, so it is only necessary to move the lifting ring to the proper point to know that the piston will remain horizontal while being lifted and carried. In order to prevent the ring from being moved accidentally the guard below the notches is so close that the ring cannot be moved without tipping it so that an oval section can be moved past the projecting points.

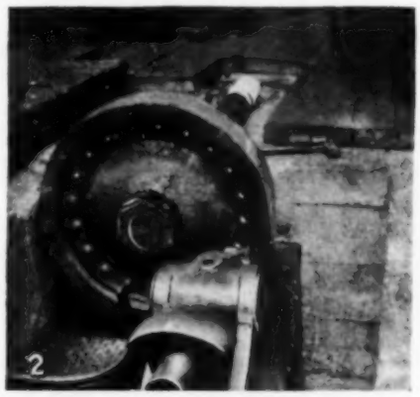


Fig. 2—A completed piston in position and the rivet heater at night

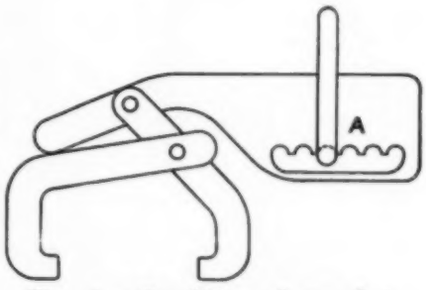


Fig. 4—Equalizing clamp that holds piston rod level

Fig. 1—Gap riveter for driving rivets in pistons.

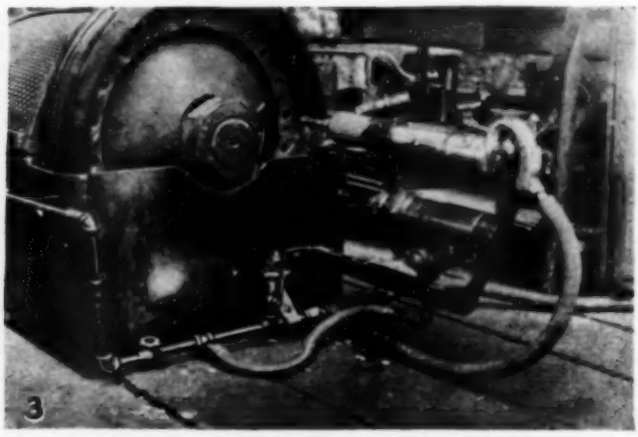


Fig. 3—Removing rivets for replacing bull-rings

Which Way Business?

RALPH E. FLANDERS
President, Jones & Lamson Machine Company

WE FIND ourselves today at a cross roads from which we may proceed in either of two well marked directions. This is supposing that we have decided not to stumble around in the brush any further, but to take or make a road of some sort.

The choice that is presented to business is that between: (1) social or governmental control of certain major elements of our operations combined with a continuation of free enterprise in details; and (2) a surrender to a large degree of social or governmental control of the details of business.

Has the day of free enterprise passed? Is the new era to be one of a regimentation of compulsory and standardized business operations, or can society so govern itself that business can serve broad social ends while preserving a wide measure of freedom and subjecting itself only to self-accepted discipline?

Is competition a proved failure, in part or as a whole? What elements must be abandoned? Is it necessary to adopt any or all of the following policies: minimum wages? maximum hours? adjustment of production to consumption by trade agreement? fixing of prices? production quotas for the individual firms of an industry? partition of sales territories between the individual firms? a "five-year-plan" for the United States?

It is not the fashion just now to concern ourselves deeply with the processes by which we came into the fix from which we are recovering. This is most unfortunate, for it leads to our being offered remedies for evils which did not exist, and to being asked to repent and make restitution for sins which we have never committed. So let us see what really did happen to the country.

Briefly, the boom, the panic and the depression were the result of four groups of causes. They were:

1. The war and its results.
2. A typical cyclic business disturbance of unprecedented severity.
3. Certain follies in the field of international finance.
4. An essentially unstable structure of our highly mechanized civilization upon which the preceding forces acted with destructive results.

Among the effects of the war, the most serious were caused by the means by which it was financed. In part this was done by the direct action of selling government bonds, due to be paid and retired at a given date. In part it was done by the more insidious processes of credit inflation, which, acting through the ordinary financial mechanisms, generate a corresponding body of private indebtedness comparable in volume to the governmental indebtedness, but not formally reckoned as a part of the future bill to be paid.

To most of us credit is a mysterious thing. When we are told that only about one-fifth of our business is done with "hard money" or its equivalent, we are left wondering what may be the nature of the other four-fifths.

In its essence bank credit is generated by borrowing. The borrowers' promise to pay is transmuted into the negotiable form of a checking account and is sent out to do the business of the country. This bank-credit-money is therefore based on indebtedness. Its worth depends on the general credit of the mass of business men, which in turn depends on the prospects of business itself. If it is short-time credit it is reasonably safe. It is the application of credit to long-term indebtedness that is dangerous.

The rapid and forced expansion of credit (and of indebtedness) by which wars are financed result in a continuously rising price level of goods and services, which in turn generates a continuing easy progression of the upward movement. All of the indebtedness, private and public, by which war is financed, is incurred at high price levels. After the emergency has passed, and the time comes to pay, the act of retiring indebtedness on a large scale takes place on an ever lowering price level. The net result is some billions of dollars borrowed at a high price and income level which have to be met and paid at a low income level. For a large part of the indebtedness, payment becomes impossible on such terms.

Besides the government generated monetary inflation, there was a government generated production inflation, both of manufacturing plants and their output, and likewise of agriculture and its products. The official pressure for agricultural expansion was particularly strong.

As a result, young and enterprising farmers took over large acreages from older ones, on mortgages, at values based on inflation prices. The policy was effective in its immediate results but left farmers with an undue proportion of the resulting burden of debt. The increased production from the new land brought under cultivation, when added to the revival of production in the belligerent countries, played its part in lowering prices and decreasing the ability of the farmer to meet indebtedness.

The third important contribution of the war to our current distresses lies in its destruction of what was a fairly smoothly operating mechanism of foreign trade and international finance. The burden of international indebtedness is if anything more intractable and disturbing than the domestic burden which has been described. The typical post-war nationalism has set up new trade barriers on new frontiers and raised those on the old ones. Disturbed political conditions disturb the flow of funds and goods as national credits ebb and flow.

If we consider the three major phenomena just described — monetary and agricultural inflation and post-war disorganization—and trace their effects during and after the two previous periods of general warfare—the Napoleonic wars, and the mid-century disturbances of which our own Civil War was the culminating feature—if we review history in this manner we find that much of our recent experience which we thought to be new is old indeed, and we

are led to wonder why it was not all foreseen long before.

Mercifully, having taken the plunge, we were spared that foresight. In sober truth "war is hell"—not only while it is being waged, but for a generation after.

The processes of recovery from war conditions were interrupted by a period of stabilized prices and mounting prosperity. The period was one of unusually rapid improvement in production machinery and processes and in business management. It seems probable that the element of initial cyclic unbalance lay in the large profits which resulted therefrom. Too large a share of the returns from industry went to the savers and investors and too little to the spenders and consumers. This resulted first, in a tendency to build new plants in advance of the provision of purchasing power to absorb the goods produced; as the sufficiency of productive plant became evident, there followed a period in which funds flowed by preference into the securities of existing companies, which were bid up sky-high in the process; and, finally, there followed the manufacture and sale of secondary and tertiary securities of purely speculative earning power, based on the underlying bona fide earning stocks.

These last phenomena are but other aspects of the same inflationary process which was described in connection with war financing. In this case, however, it was privately rather than governmentally generated, and it was based on rising speculative profits and security prices instead of on rising wages and commodity prices. But in its inevitable crash it left behind it the typical burden of indebtedness to be repaid in a period of impossibly low incomes and low prices. In this our whole banking structure was deeply involved, as we all know.

The seriousness of the situation was doubled by the fact that the new speculative indebtedness was added to the large residuary war indebtedness, and that the cyclic deflation joined hands with the war deflation and thereby progressed with redoubled speed.

As an exaggerative force in this cycle, governmental policies played their part. Construction of federal, state and municipal works was expanded at the wrong time and contracted at the wrong time. Taxation was wrong in timing and kind. Bond retirement was not carried out at the proper time to the desirable degree, so that governmental credit was low when borrowing would have been advantageous.

Summing up, the important factors in the cyclic disturbance appear to lie in mal-distribution of wealth, in credit inflation and speculation, and in faulty governmental policies.

As to the imbecilities of international finance, little needs to be said here except to call attention to the most obvious of them, which is that, in the face of the impossibility of collecting war debts on anything like the prearranged scale, we continued to pour out national credit into European and South American countries, through governmental and private channels, under conditions and to amounts which make repayment a fantastic mirage. The top-heavy structure broke in the second year of the depression and prolonged and deepened its intensity.

Mechanized Civilization Unstable

As the final group of causes, we have certain elements of instability which appear to be inherent in a highly mechanized civilization. They weaken its resistance to the overturning forces which have just been described. A brief and incomplete list follows.

There is, first, the shift from subsistence to staple agriculture which takes place as transportation is improved and world-wide commerce is developed. Subsistence agriculture is the most stable of all occupations, being dependent only on the vagaries of the weather. It is, however, one which maintains only a low scale of living. Staple agriculture, as of cotton or wheat, promises greater returns, but is dependent on national or international business conditions whose variations are far more serious than those of the weather.

A second factor is the shift from subsistence agriculture to urban industry—again an advance to a higher plane of living while business is good, but disastrous when the bottom drops out.

A third unsettling movement is the shift from the manufacture of the staples of existence to the industries producing accessories and luxuries. Again we have an advance in the scale, but one which can be held with difficulty, since the slightest business recession disproportionately reduces employment in these less necessary occupations.

A fourth unstable element is the increasing importance of the capital goods industries, which produce manufacturing equipment, engineering structures, etc. These again cease to function during a depression, and recover but slowly, with corresponding distress to their employees. There is no need to dwell on this point if the reader is a builder of machine tools or locomotives.

Lastly, there is a steady flow from productive occupations in general to sales and service occupations of various sorts. These latter are characteristic of a more developed civilization, and are in great part desirable in themselves, but they are subjected to drastic reduction as business falls off.

These elements (and others not mentioned) are probably far more valid and effective than the much-discussed factor of technological unemployment. Popular theory requires that such unemployment should have been increasingly evident even during good business; yet reputable statisticians have been unable to verify this contention.

It would appear that *instability* of employment, rather than its *decrease in volume in good times*, is the dubious fruit of our technological tree. We must remember, however, that the instabilities listed are tied up with human progress, so that our remedies must be aimed at the disturbing forces fully as as much as at the unstable organizations.

This statement of causes might not be subscribed to as a whole by any other student of the situation, yet it probably represents a fair consensus of judgment of the scores of specialists who have been primarily concerned each with his own particular interest.

In this variety of causes it is noticeable that only a part are in the proper realm of industry, although we must take some responsibility for the improper invasion of our realm by financial-speculative operations which have made so much trouble in the recent past. Aside from the necessity of rigorously excluding that element by all means, whether of persuasion or compulsion, of enlightened opinion or of law, our important responsibilities would seem to be concerned with the distribution of wealth and with our own natural but secondary elements of instability in employment. The remainder and the heavier burden of responsibility lies at the door of government and of finance

The National Recovery Act is the means of attack used at the present moment on the problem of economic control. In the light of the causes enumerated above, let us go over the various elements involved in the Act and in the codes so far as they have been presented. Let us try to see what is justified as a permanent policy and what is harmful even as an expedient.

The following are among the elements which it would seem that industry should be willing to accept as permanent policy:

Shorter Hours. While there is nothing in the causes of our present situation which gives to shorter hours fundamental curative effect, the policy does have its uses in distributing work during recovery; and it may be properly accepted as an overdue social dividend on the operation of our labor-saving machinery. If at this time we cannot in 35 or 40 hours a week make all that we wish to consume, then our improved mechanisms are not what we claim them to be. As a matter of fact, if we can

arrange by proper means to keep men working 35 hours a week year in and year out, instead of shutting them down for the months or years of hard times, we will be adding to their productiveness instead of subtracting from it.

The *raised age limit* (elimination of child labor) is a matter of human decency which we can all accept.

The *minimum wage*, properly set, comes in the same category.

The *prohibition of sales below cost*, except in carefully regulated exceptions for liquidation purposes, is a step which may tend to reduce the violence of business fluctuations, and will certainly work out to the best good of all in our day-by-day business relations.

Elimination of abuses in general of the types peculiar to the individual trades, should be accomplished for the same reasons as the prohibition of selling below cost.

Regulatory taxation, more carefully devised than that in the Recovery Act, should be accepted as its purpose and merits become apparent. In a proper arrangement of taxation lies one of the simplest methods of controlling the distribution of wealth as between consumers and investors. Industry has far more to gain than to lose by such a control.

The elements of which we should beware are numerous. In general they are of the type which will inevitably lead to an increased power and activity of the government in our private business policies without any corresponding gain to society as a whole. The following are among the dangerous tendencies which some enthusiasts are endeavoring to fix upon industry:

Limitations on the use of machines. Having declared a dividend of leisure in shortening the working week, continued improvement of machines and continued extension of their use is the means by which society may expect to rise to a higher standard of living. This is so obvious that it is indeed strange to find it questioned at all.

Price setting is another seductive, but dangerous, possibility in the new legislation. Price setting will inevitably lead to governmental control of many sorts and of undesirable degree. The greatest danger lies here.

Allocation of output and of territories, except for certain natural resources, is likewise a dangerous process. It appeals particularly to the large established industries who wish to hold their present gains with as little effort as possible and are willing, if permitted to do that, to submit to an increased measure of governmental control. These proposals are those of "The Tired Business Man" as Virgil Jordan called him in a recent article in the *Iron Age*. In this matter, established and matured firms are ranged against the vital and developing ones to the disadvantage of society as a whole. It is doubtful if even these established firms would complacently accept governmental control if they could see the end from the beginning.

The final thing of which we must beware is the acceptance on the part of industry of anything like full responsibility for the sum of economic evils. This full responsibility must be disavowed vigorously and unremittingly, while we continue with willingness to accept such responsibility as does belong to us.

That we should continuously call attention to the major evils which lie within the areas of government and financial activity is a public duty. Otherwise, those evils will fail of their proper attention and we will be launched on an era of minute governmental control of business from which no good can come and from which we will never escape.

Value of the Profit Motive

The dangers of such a situation are serious. The enormous extent of our operation in manufacturing and distributing material goods, their unimaginable variety, the incalculable complexity of the courses they take, the innumerable final desires and satisfactions they reach and serve, are beyond human comprehension or calculation. It is the profit motive which ultimately maintains these labyrinthine mechanisms, and it is the profit motive which is under fire.

The degree of success which Russia, without the profit motive, has attained in an arbitrary handling of this intricate problem has been due to three factors. First, her economy is until now a secondary one, feeding on the finished mechanisms and processes of more vital and self-sustaining nations. Second, her substitute for the profit motive is a discipline that is essentially self-denying; and it remains to be seen whether, in the face of a world incredibly rich in material possibilities, such a principle can indefinitely maintain its power. Third, such measure of success as has been or is likely to be attained in the near future is at the expense of a simplification of the problem which involves a low scale of living and a standardized existence. Only so can the task be brought within the range of human abilities.

The basic objections to a governmentally managed economy are that this solution is impossibly difficult if we are to preserve the rich material existence which we now enjoy or can enjoy; and that the alternative of a simplified and standardized existence, brought within the limits of human ability, is so false to our desires and possibilities and to the direction of our historic development as to be impossible except as a forced adjustment to some destructive catastrophe.

The hopeful possibility lies in a frank recognition of the usefulness of that force of nature which we call the profit motive; and in a purposeful attack on the problem of controlling it in the same way that other natural forces are controlled by the engineer.

The problem is akin to that of flood control and irrigation, and of harnessing to human uses in the power plant and transmission line the energy which manifests itself destructively in the lightning.

It is impossible to give details in a brief discussion like this. But the general line of attack may be indicated. Governmental and social control should be so directed as to minimize the element of unsocial speculative profit, as distinguished from the profit which arises from serving public needs through the legitimate operations of private business. Foreign policies leading toward future warfare must come under critical scrutiny.

There are involved government policies of expenditures, borrowing, and taxation. Also concerned are general financial policies of discount rates, the expansion and contraction of money and credit and of foreign investment, and the continued development of sound practices in commercial and investment banking. There must also be consideration of the kind and amount of industrial and financial information available to the investing public. There is nothing in such dry policies to excite wild popular acclaim or to enthuse the amateur statesman, yet real social progress may be built of such dry materials, particularly if the building operations are fired with that political genius which our President has so abundantly revealed.

But the prime essential is a realistic viewpoint which is willing to take account of all the facts; and among those facts none are more significant than the limited though real effectiveness of industrial policy, and the limited capacity of political intelligence and experience to control in detail the elements of a rich and developing material existence.

Yet, with all the doubt which the situation holds, the immediate duty of industry is not only to protest as occasion requires, but to give prompt obedience and loyalty to the emergency programs as they are laid upon us. Only so can we deserve credit for their success, or escape blame for their failure.

EDITORIALS

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EDITORS

The Codes Present a Great Opportunity

Machine tool builders have an almost Heaven-sent opportunity to rid themselves of an incubus that has grown, under the guise of free engineering service, to the proportions of a Frankenstein. This feeling was emphasized by a recent visit to the engineering department of a well known builder where we saw thousands of dollars worth of valuable suggestions, layouts and data, prepared to secure orders that never materialized.

Begun in a small way when the building of machine tools was just becoming a real industry, the practice has grown until it is a menace, even to the larger companies. Urged by the builders themselves, users have learned to put their problems up to them, either as a check on the users' own engineers or to save the expense of hiring high class production men. Many suggestions and layouts have been asked for with no intention of purchase, but to see how nearly the practice of the asker agreed with recommendations. Data on speeds, feeds and cutters, as well as suggestions for fixtures, have saved thousands for the users who benefit most in any case, and have cost the builders corresponding amounts.

This practice is unfair to all concerned. It tends to lessen the value of the production man's job. It places a burden on the machine builder, and is particularly unfair to the more desirable customers who demand no engineering service, but who pay for all of it that produces no orders. The manufacturer who employs competent engineers and production men, who orders machines from a study of their advantages, who does not ask expensive service, is penalized under existing practice. He now pays for the education of his less competent competitor.

There is no question of the value of suggestions from the builders of machine tools. They have helped greatly in reducing machining costs to their present low levels. Any manufacturer will find it a profitable investment to secure such suggestions when confronted by new problems. But the information should be paid for just as willingly as the bill of a consulting engineer for like service would be honored.

Fairness to all concerned demands a drastic change in the practice that has grown to such dangerous proportions. What better opportunity can be expected than that now presented?

Seven-League Boots for Executives

Large plants, with imposing office buildings in front, are very impressive on a letterhead or in the catalog. But they impose a daily burden on many shop executives of which the architect never dreamed. Conveyors for materials are common, but the general foreman or superintendent walks many a weary mile during the day. These huge plants cause great bodily fatigue which may easily react on the mental activity of the men responsible for results. And the time consumed in transit is considerable.

One large locomotive works in England built a special track and car-locomotive combination for use of its executives. Plants with scattered buildings use automobiles from shop to shop. But none of these meet the needs of the huge single shop building.

Locating the office in a central position would help some, but would lose the architectural effect that makes its appeal to the visitor or in illustrations. Some form of shop transport, other than the roller skates or bicycle now used to some extent, seems to be in order. Perhaps some genius will develop a form of overhead conveyor that will not be mistaken for those used for castings, sides of beef or other commodities. Or the moving platform idea may have as yet undeveloped possibilities. If not, leg work may add another incentive to decentralization and the use of smaller plant units.

A Dividend of Leisure

On another page of this number (*AM*-Vol. 77, page 562), Ralph E. Flanders, in enumerating dangerous elements in government regulation of industry, includes the following:

"*Limitation in the use of machinery.* Having declared a dividend of leisure in shortening the working week, continued improvement of machines and continued extension of their use is the means by which society may expect to rise to a higher standard of living. This is so obvious that it is strange to find it questioned at all."

It is indeed strange, and yet vaguely understandable, that certain groups of superficial thinkers should embrace the sophistry of a ban on mechanical progress. What is utterly inexplicable is the action of supposedly hard-headed manufacturers in attempting to write into their NRA codes limitations that virtually constitute a moratorium on the purchase of new equipment. Apparently they reason that if their competitors are prohibited from modernizing, they themselves will be able to drift along without further outlays for equipment.

The short-sighted viewpoint could have only suicidal results. Continued high-cost manufacture would ultimately reduce purchasing power throughout the country. Unemployment in the capital goods industries would defeat the entire aim and purpose of

NIRA. The very manufacturers who are now sponsoring such restrictions would also suffer heavily even though they may be making consumer rather than capital goods.

Some of the clauses in these codes are phrased to vest equipment control in a code authority dominated by established firms in the field. Under this set-up may be seen an expedient to make it impossible for new enterprises to enter the industry. Here we have the sorry spectacle of high-cost plants apparently ready to drag their industries into the mire of stagnation rather than to make the effort to gird themselves for future competition.

Certainly neither the framers of NIRA nor its administrators have any thought of crippling American industrial progress and invention. Let us, then, celebrate our dividend of leisure by new advances in industrial development that will make possible future dividends in higher living standards.

CHIPS

Washington—On marches the blue eagle with the President's approval of codes for oil, lumber, steel and automobiles . . . Even the recalcitrant coal industry shows signs of falling into line . . . Auto builders win victory in retention of clause denounced by labor leaders . . . Machine tool builders and a score of other branches of metal-working industry file their codes . . . Johnson "interprets" the much-disputed Sec. 7 (a) . . . rules that the terms "open shop" and "closed shop" are out of NRA dictionary . . . Dr. Sachs, blue eagle economist, advocates equipment modernization as part of NRA program . . . Meanwhile, the General denounces banks for not doing a constructive credit job and appeals to R.F.C. to finance "blue eagle" industries . . . Reserve Board counters by trebling its open market bond buying . . . Nation-wide radio broadcasts inaugurate intensive drive for consumer NRA agreements . . . Johnson bans boycott as one of eagle's claws . . . Raymond Moley, assistant Secretary of State resigns from "brain trust" to become editor . . . President sets up board for bank deposit insurance to become effective January 1 . . . Votes of Texas and Washington bring repeal states to 24 . . . Government buys pigs to bolster hog prices and aid farmers.

Foreign—Conference between Premier Mussolini and Chancellor Dollfuss results in Italian pledge to aid Austrian trade . . . Austria gets a free zone in the Port of Trieste . . . Liner *Rex* makes record-breaking Transatlantic voyage . . . Germans are worried as Hitler trade boom languishes . . . Peasants get Junkers lands in response to Nazi demand to establish homesteads . . . Cubans to hold election February 24 . . . Merger is arranged between Cunard and White Star lines . . . Norman H. Davis to press international supervision of arms manufacture at Geneva parley in October . . . British sentiment grows for "treaty strength" Navy with 25 new cruisers and 15 new destroyers . . . Paris fears pound will follow dollar if our currency falls lower . . . Ex-utility magnate Insull is rearrested in Greece at United States' request . . . Lindbergs welcomed in Copenhagen after exploratory air cruise across the Atlantic . . . Canada fears loss of trade through effects of NRA program.

Finance—Dollar drops again as observers here and abroad predict currency inflation to spur NRA drive . . . Britain may cooperate if debt concession is made . . . Claiming his knowledge "second-handed" Hoover declines to testify at Detroit bank inquiry . . . R.F.C. refuses loan to Western Pacific R.R. because of insufficient collateral . . . Security markets shake off lethargy in new advance.

Industry—Return of 1,100,000 to work since March puts employment at October 1931 level . . . Survey shows that 1,500,000 families are off relief lists . . . Workers living costs rise 3.3 per cent in July . . . July auto output is 239,629, slightly off from June, but up from 116,615 in 1932 . . . 1,500,000 auto sales forecast for 1933 . . . New York committee is formed to study leisure of short-hour workers . . . I.C.C. approves merger of 12 railroads headed by Rock Island . . . Railroads to study pooling of facilities under Eastman plan . . . Government arsenals add more men on strength of public works funds . . . Pierce-Arrow wins independence from bankrupt Studebaker Corporation . . . International Business Machines adds third new wing to its Endicott, N. Y., plant.

Trade—Grain prices recover as peg on wheat by Chicago Board of Trade is removed . . . New York utilities fight light rate cut . . . 31 nations reach accord at London to limit wheat production and fix price . . . stock of 960 million bushels as of August 1 sets new high . . . Survey shows consumer income is increasing faster than buying.

Indicators—Twenty-nine Class A railroads show 390 per cent gain in net income for July . . . Power consumption for week of August 17 is 15.2 per cent above last year . . . *Iron Age* index of steel production drops 3 points to 50 per cent . . . Foreign trade activity increases with July exports of 21 per cent and imports up 17 per cent . . . *Business Week* index at 64.8 is slightly off from preceding week . . . Carloadings, up 12,086 units in week, are 116,405 above last year.

Machine Tool Builders Submit Code

Falling in with the popular trend toward codification, the National Machine Tool Builders late last week submitted their code to the NRA. Interpretative paragraphs following the mandatory labor section complied with General Johnson's ruling to avoid the term "open shop" in a fashion similar to that in the automobile code.

Forging machinery is specifically classed as coming under this code. Adherence to the Machinery and Allied Products Institute is included.

Provision is made for the setting up of a uniform accounting practice. Selling below cost, except obsolete product, is ruled out and the posting of standard prices is compulsory. Other clauses such as those on child labor, exports, and code authority follow in general codes previously submitted. The text follows:

THE INDUSTRY

The term "Machine Tool Industry" as used herein is intended to include all those engaged in the manufacture for sale of machine tools and forging machinery, and parts thereof.

The term "Parts Thereof" includes all power driven complete metal working machines, not portable by hand, having one or more tool and work holding devices used for progressively removing metal in the form of chips.

The term "Forging Machinery" includes all hot and cold forging machinery, excepting hydraulic machinery.

The term "Parts Thereof" includes all parts for machine tools and forging machinery, jigs and fixtures, and such small tools and accessories as are now, or may be made by builders of machine tools and forging machinery.

APPLICANT

Art. II—The applicant for this code is *The National Machine Tool Builders' Association*, a trade organization, all members of which are engaged in such manufacture for sale, and which organization is truly representative of the industry.

This Code is presented by applicant, in association with Machinery and Allied Products Institute.

Applicant organization imposes no inequitable restrictions on membership therein. The code presented by it is not designed to promote monopoly, will not operate to oppress or eliminate small enterprises, will not operate to discriminate against them, and will tend to effectuate the policy of said Title I of the National Industrial Recovery Act.

Article III is devoted to definitions of the terms used, and Article IV specifies that the code become effective eleven days after the President's signature.

Article V, headed Employment, starts with the clauses required by Section 7 (a) of NIRA. Then these paragraphs follow:

It is also declared, that:

Nothing in this Code shall prevent the selection, retention or advancement of employees on the basis of their individual merit, without regard to their affiliation or non-affiliation with any labor organization, or with any other lawful organization.

Nothing in this Code shall prevent any individual employee from bargaining individually with his employer, if both so desire.

The Industry has recognized the right of the employees of any employer, to bargain collectively with such employer through representatives chosen by such employees from among themselves, without interference, coercion, or restraint from their employer or from anyone.

These principles, long recognized and practiced in the Industry, are in the judgment of employers, in the interest of the employees, and in the opinion of the employers should be maintained and protected.

MINORS

Art. VI—No employer shall employ any person under the age of sixteen years.

WAGES

Art. VII—(a) On and after the effective date the minimum wage that shall be paid by any employer to any employee engaged in the processing of the products of the industry, and in labor operations directly incident thereto, shall be thirty-five (35) cents per hour; unless the rate per hour for the same class of labor on July 15, 1929 was less than thirty-five (35) cents, in which case the rate per hour paid shall be not less than the rate per hour paid on July 15, 1929; and provided, that in no event shall the rate per hour paid be less than thirty (30) cents; and provided, that casual and incidental labor and learners (other than apprentices) may be paid not less than eighty (80 per cent of such minimum wage, but the total amount paid by any employer to such casual and incidental labor and learners at such reduced rate shall not exceed in any calendar month seven and one-half (7½) per cent of the total wages paid by such employer to all process labor.

(b) On and after the effective date, the minimum wage that shall be paid by any employer, to all other employees, shall be at the rate of $14 per week, whether calculated on an hourly, weekly, monthly or piece-work basis, in accordance with the usual custom of the employer; provided, however, that office boys or girls, learners, and casual employees may be paid not less than eighty (80) per cent of such minimum wage, but the total amount paid to such office boys or girls, learners and casual employees at such reduced rate shall not exceed in any calendar month seven and one-half (7½) per cent of the total amount paid by such employer to all employees covered by the provisions of this paragraph (b).

(c) The minimum rates of wages pro-

• INDUSTRIAL REVIEW •

With metal-working executives away in Washington or in codifying huddles at home, salesmen are having little success in closing orders. Inquiries are still abundant, but manufacturers watching the blue eagle hover 'round wonder where it will finally light. Meanwhile they are going slowly with new commitments. Hope of a revival of Russian orders is based on a projected Soviet aircraft plant and the possibility of recognition. Industrial forecasts range all the way from pessimistic to optimistic with quite a few forthright admissions of complete uncertainty.

New York is doing better than the average with good August business resulting from naval construction and oil well activity. New England equipment salesmen for the most part are back on the job full time with plenty of leads but few orders.

Pittsburgh looks for better things in September, after most of the codes are out of the way, basing its hope on the increasing number of active inquiries. But August is far behind July in volume. Cincinnati is troubled by the labor implications of the NRA program. Machine tool makers are subsisting largely on hope with orders at about half the June-July level.

Cleveland, contrary to the general trend, reports August a better month than July, and looks for a continued steady improvement. Chicago notes a marked drop-off in sales from the first of the month, but believes the July spurt will be renewed.

Detroit is disappointed because of the shrinkage in orders during the past two weeks. However the signing of the auto code is regarded as a good omen. Activity from brewing equipment and machinery having subsided, Milwaukee finds its shops slowing up with some lay-offs. Shipments this month have been good, but there is insufficient backlog.

Business in St. Louis is spotty although some manufacturers are going along at a comfortable pace. One strike is reported. San Francisco feels the general recession.

vided in this Article VII shall apply to all employees in all localities, unless the President shall fix for this or a similar industry or industries, a lower rate for particular localities.

(d) Nothing in this Article VII shall apply to, or affect, any employee apprenticed to any employer by an indenture made in pursuance of the laws of any state of the United States, or by a written contract under any apprentice system established and maintained by any employer.

(e) Nothing in this Article VII shall apply to any employee who by reason of physical disability or infirmity is competent for only light employment.

(f) Not later than ninety (90) days after the effective date, each employer in the industry shall report to the President, through Supervisory Agency, the action taken by such employer in adjusting the hourly wage rates for all employees receiving more than the minimum rates provided in paragraph (a) of this Article, but receiving less than $35 per week of regular work period.

HOURS

Art. VIII—On and after the effective date no employer shall employ:

(a) Any employee engaged in the processing of the products of the industry, and in labor operations directly incident thereto, in excess of forty (40) hours per week.

(b) Any other employee, except executives, administrative, supervisory and technical employees and their respective staffs, and traveling, sales, and service employees, in excess of 40 hours weekly.

Provided, however, that these limitations shall not apply to conditions of seasonal or peak demand, which create an unusual and temporary burden for production or installation; in such cases such numbers of hours may be worked as are required by the necessities of the situation; but not to exceed forty-eight (48) hours per week for any six weeks in any calendar six months period; *provided, further,* that in such special case, at least time and one-third shall be paid for hours worked in excess of the maximum; *provided, further,* that these limitations shall not apply to employees on emergency, maintenance, and/or repair work, or to very special cases where restrictions of hours of highly skilled workers would unavoidably reduce or delay production; but in any such special case at least time and one-third shall be paid for hours worked in excess of the maximum.

SUPERVISORY AGENCY

Art. IX—The applicant organization, acting by or through any committee or section thereof, to which it has heretofore delegated authority, is hereby designated the *Supervisory Agency* for administering, supervising and promoting the performance of the provisions of this code by the members of the industry.

The members of the National Machine Tool Builders' Association and the subscribers to this Code agree to contribute to the Association office figures covering their company's experience, for compilation of industry reports on the following items:

(1) Monthly reports on total volume of new orders, in dollars, classified according to foreign and domestic destinations.

(2) Monthly detail reports classified by types and sizes of machines agreed upon by members of each group, covering unfilled orders, new orders, cancellations, shipments, and stocks on hand; in units.

(3) Monthly reports on wages paid, by classes of labor.

(4) Monthly reports of average hours of employment, by classes of labor.

It is, however, expressly provided, that the jurisdiction of Supervisory Agency under this Code over any employer, is limited to that portion of the business and employment of such employer which is within the industry.

DATA CONFIDENTIAL

Art. X—Except as otherwise provided in the Act, all statistics, data and information filed in accordance with the provisions of the Code shall be confidential.

The statistics, data and information of one employer shall not be revealed to any other employer, except, that, for the purpose of administering or enforcing the provisions of the Code, Supervisory Agency by its duly authorized representatives (who shall not be in the employ of any employer affected by this Code), shall have access to any and all statistics, data and information, that may be furnished in accordance with the provisions of this Code.

CODE OPEN TO ALL EMPLOYERS

Art XI—Any employer may participate in any endeavors of applicant in the preparation of any revisions of, or additions or supplements to this Code, by accepting the proper pro rata share of the cost and responsibility of creating and administering it, either by becoming a member of applicant, or by paying to applicant an amount equal to the dues from time to time provided to be paid by a member of applicant in like situation.

ACCOUNTING AND COSTING

Art. XII—As a basis for the determination of a fair price for each unit manufactured and distributed by any manufacturer or his agent, the National Machine Tool Builders' Association agrees to have drawn up a practical system of cost finding, designed to provide sound methods of dealing with cost problems peculiar to the machine tool industry, to be used by the industry with such variations therefrom as may be required by the individual conditions affecting any employer or group of employers.

Art. XIII—No employer shall sell or exchange any product of the Industry, manufactured by him, at a price, or upon terms and conditions, which will result in the customer paying for the goods received, less than the cost thereof to the seller, determined in accordance with the method of costing above described; *provided, however,* that obsolete product may be disposed of by any employer at a lesser price, but only if such employer, not less than two weeks before such disposal, has filed with Supervisory Agency, for immediate transmittal to all direct competitors, a statement in writing, setting forth an identifying description and quantity of such equipment.

PRICE LISTS

Art. XIV—Every manufacturer shall establish and announce his own prices for his standard product, accessories, and/or attachments, based on consideration of his costs, breadth of the market for that type of product, and utility to the user. Such prices shall then be the list or published prices to be quoted to all customers, whether the product is sold direct by the manufacturer or through his authorized agencies or dealers. These list prices shall remain in effect, and no deviation may be made from them until changes are made as provided in the following paragraph of this Article.

In order to effect changes in list or published prices, and at least 10 days before new prices are intended to become effective, the manufacturer shall file notice of change, including a schedule of new prices, with Supervisory Agency, and at the same time supply Supervisory Agency as many copies as may be required to mail one copy to each member of the directly competitive group.

For a period of 10 days following the date on which the new prices become effective, the manufacturer or his agents or dealers may accept orders on quotations which were outstanding on the date the notice of change was filed.

All quotations for domestic destination shall be made f. o. b. cars at point of manufacture, or if delivered price is quoted, full transportation costs shall be added.

INVESTIGATIONS

Art. XV—Aggregations of employers having a common interest and common problems will be grouped by Supervisory Agency for administrative purposes into various subdivisions, or product classifications.

In each subdivision or product classification there will be a sub-supervisory agency approved, or appointed, by Supervisory Agency. If formal complaint is made to Supervisory Agency that provisions of this Code have been violated by any employer, the proper sub-supervisory agency shall investigate the facts, and to that end may cause such examination or audit to be made as may be deemed necessary, and shall report the results of such investigation and examination to Supervisory Agency.

UNFAIR PRACTICES

Art. XVI—Unfair practices shall be deemed to be practices or acts which by subterfuge, concealment, misrepresentation, or by any form of discrimination, result in selling below published prices, or in deceiving or misleading purchasers, or in misrepresenting the products of competitors. Any such unfair practice is hereby declared to be and to constitute an unfair method of competition.

EXPORT TRADE

Art. XVII—Except as may be subsequently set forth in a specific or supplementary Export Code for the industry, the provisions of this Code now or hereafter adopted with regard to prices, discounts, deductions, allowances, extras, commissions or methods and/or terms of sale, are not to apply to direct export sales or to sales in course of export (i. e. sales destined ultimately for export) or to sales of materials used in the manufacture of products for export. The term "export" shall include in addition to shipments to foreign countries, shipments to such United States possessions as may be defined by the industry.

STATUS PRIOR TO EFFECTIVE DATE

Art. XVIII—Prior to its approval by the President, applicant may at any time change or modify any provision of this code (except those provisions required by Sections 7(a) and 10(b) of the Act), or may withdraw this Code.

Any change or modification of this Code, effected by such approval, shall be subject to the consent of applicant, and shall be effective if approved by applicant.

RIGHTS OF PRESIDENT

Art. XIX—As provided by Section 10(b) of the Act, the President may from time to time cancel or modify any order, approval, license, rule or regulation issued under Title I of the Act.

AMENDMENTS CONTEMPLATED

Art. XX—Such of the provisions of this Code as are not required by the Act to be included herein, may, with the approval of the President, be modified or eliminated as changed circumstances or experience may indicate.

This Code is intended to be a basic Code. Study of the trade practices of the industry will be continued by Supervisory Agency with the intention of submitting from time to time additions to, or revisions of, or supplements to, this Code; such additions, such revisions, and such supplements, however, shall conform to and be consistent with the provisions of this Code as now constituted, or hereafter changed.

Any such amendments, additions, revisions, or supplements, proposed by Supervisory Agency, and approved by the President, shall be in full force and effect after such approval.

SEGREGATION OF INDUSTRY

Art. XXI—If any employer of labor in the industry is also an employer of labor in any other industry, the provisions of this Code shall apply to, and affect, only that part of his business and product which is included in this industry.

More Metal-Working Codes Shower Down on Washington

Washington — Feverishly working under an avalanche of new codes, Deputy Administrators on General Hugh Johnson's staff are attempting to speed the wings of the Blue Eagle. In addition to the Machine Tool Builders' code a large number of others in the metal-working field have recently been submitted to NRA. Among these are the following: agricultural implements, automobiles, files, gasoline pumps, automatic sprinklers, textile machinery, aluminum, plumbing fixtures, slide fasteners, steel heating boilers, chains, chain hoists, railway special track equipment, scientific apparatus and bicycles. Distributors of industrial supplies and machinery have also entered their codes.

Hearings on the agricultural implement code will begin at 10 A.M., on September 20, at at Willard Hotel. The code provides a maximum work week of 40 hours for factory employees averaged on a yearly basis of 52 weeks. No employee is to be worked more than eight hours in any one day. A leeway of 10 per cent is permitted for workers engaged in care and maintenance of plant equipment. The minimum wage is based on a sliding scale of from 30 to 40 cents an hour depending on the manufacturing area with a 5-cent per hour differential for female workers on light work.

The code points out that the industry's sole customer is the farmer whose needs vary greatly with weather conditions and the various kinds of insect pests which affect his crops. This causes large fluctuations in farm yields which in turn cause emergency demands for implements. For this the code provides "to meet the farmer's immediate demands a considerable variation in factory hours has always been essential and must be permitted." An open shop clause is also included, but in the light of General Johnson's recent announcement, this may be subject to revision.

In addition to the hearing on the knitting machinery manufacturers' code, reported in our last number, hearings have since been held for the laundry and dry cleaning machinery manufacturers, August 23, textile machinery manufacturers, August 25, and automatic sprinkler manufacturers August 28. Hearings start today on the plumbing fixtures industry which includes enamel cast iron plumbing fixtures, vitreous china plumbing fixtures, sanitary seats and plated brass plumbing fittings. The boiler manufacturers' code hearing is set for August 31.

More Associations Join MAPI

At the meeting of the executive committee of the Machinery and Allied Products Institute, on Aug. 16, 25 additional applications of trade associations for membership were approved. Additional applications, which are being received daily, will be acted upon at the next meeting. Among the many representative associations already admitted to the MAPI fold are the following:

Compressed Air Institute, Locomotive Institute, Mechanical Press Builders' Association, National Machine Tool Builders' Association, Oilwell Machinery Manufacturers' Association, Refrigerating Machinery Association.

Forris D. Stevens is now Washington representative for MAPI with an office at 214 Southern Building. M. J. Reed, recently appointed New York representative of the Institute, has offices at 2 West 45th St. Mr. Reed was formerly secretary of the Diesel Engine Manufacturers' Association with headquarters

NRA Remembers Capital Goods Industries

Washington—During the early days of the Blue Eagle, capital goods manufacturers were apparently lost sight of in solicitude for the unemployed, the consumers and the makers of consumer goods. Now they find a champion in no less an authority than Dr. Alexander Sachs, chief economist of NRA.

In a strong memorandum to General Johnson and his deputies, Dr. Sachs pointed out the vital importance—if prices for the beloved consumer are to be kept down—of urging on all their industries the sound policy of scrapping old machinery, putting in modern, making work for thousands of good spenders in capital goods plants.

Package Machinery Manufacturers Institute Organized

At Buffalo on August 21, the Package Machinery Manufacturers Institute was organized and adopted an NRA code. A committee as follows was appointed to present the code:

H. H. Leonard, vice-president and general manager, Consolidated Packaging Machinery Corp., Chairman.

Col. F. K. Knowlton, president, M. D. Knowlton Co.

Roger L. Putnam, president, Package Machinery Co.

The officers and directors elected by the Institute are as follows:

President

H. H. Leonard

Vice-presidents

Roger L. Putnam

H. K. Becker, vice-president and general manager, Peters Machinery Co.

R. T. Bacher, president, McDonald Engineering Corporation

Charles L. Barr, sales manager, F. B. Redington Co.

G. Prescott Fuller, Wire Stitching Division, Dexter Folder Co.

A. G. Hatch, general manager, M. D. Knowlton Co.

C. E. Schaeffer, asst. sales manager, Stokes & Smith Co.

W. J. Donald, of 52 Wall St., New York, N. Y., was elected executive vice-president and treasurer.

Wire Machinery Builders Organize

At a meeting held in New York, August 10, the Wire Machinery Builders Association was organized. Members present agreed upon the essential elements of a NRA code which it was voted should be submitted through the Machinery and Allied Products Institute with which the association is to ally itself. A constitution and set of by-laws were adopted and the following officers elected:

President—Philip M. Morgan, Morgan Construction Co.

Vice Presidents — L. A. Vaughn, Vaughn Machinery Co.; Josian Judd, Thomson-Judd Wire Machinery Co.

Secretary-Treasurer—George D. Hartley, Sleeper & Hartley, Inc.

Executive Committee—W. D. Pierson, Waterbury Farrel Foundry & Machine Co.; E. F. Shuster, F. B. Shuster Co.; L. A. Vaughn; E. J. Scudder, E. J. Scudder Foundry & Machine Co.

Code Committee—J. R. Dorer; A. R. Petterson, Thomson-Judd Wire Machinery Co.; W. D. Pierson.

Steel Gets Its Code

After weeks of flying sparks in Washington conference rooms, the steel industry, seasoned in the fire of government rulings and trade union threats, seems to have done pretty well for itself. It came away with a code little altered from that it took to Washington and should be well satisfied that its original provisions were so little garbled.

The first code was replete with provisions that seemed designed to be dumped overboard with a noble flourish when a noble flourish was needed. Of these the blue chip was the "open shop" clause which Robert P. Lamont, president of the American Iron and Steel Institute, withdrew in a master-stroke of showmanship. But this did not induce steel executives to sit in on a conference with William Green, A. F. of L. president, nor did it remove a later clause specifying that persons delegated by the Administration to investigate and propose new methods or measures "shall be persons not having or representing interests antagonistic to the interests of members of the industry."

Wage scales on a varying basis from 25 to 40 cents an hour in 21 districts remain substantially as originally submitted. The 40-hour week is standard with 48 hours a week maximum permitted so long as the 40-hour average is maintained over a three-month period.

In return steel took the President at his promise to "relax some of the anti-trust laws" by establishing rulings in prices, procedure in bidding, definite basing points and by setting of safeguards against price chiseling by the use of truck transportation. Only by a vote of three-quarters of the entire Institute will a member be allowed to sell at a base price below the published base price.

Satisfaction in the code is expressed by proponents of anti-trust law repeal who claim that its provisions take a long step in their direction. All in all, it looks as though steel, under the fanfares of trumpets while the hearings were in progress, came away with a declaration of independence in its pocket. Probably some industries, less experienced in the devious ways of Federal regulation, would do well to study this strategy.

President Signs Auto Code

Despite the protests of labor leaders, who scored the "company union" clause of the automobile code, President Roosevelt affixed his signature on Sunday morning. The much disputed phrasing which now stands, following the required clauses from Sec. 7 (a) of NIRA is:

"Without in any way attempting to qualify or modify, by interpretation the foregoing requirements of the National Industrial Recovery Act, employers in this industry may exercise their right to select, retain or advance employees on the basis of individual merit, without regard to their membership or non-membership in any organization."

No reference was made to the open or closed shop because of General Johnson's announcement, made last week with Donald Richberg, NRA legal advisor, to the effect that these terms were out of the NRA dictionary since they might be construed to qualify the wording of the law.

Fabricated Metal Code Is Ready

Fabricators of metal other than machinery, combined in the Fabricated Metal Products Federation, have prepared a code for NRA.

Minimum wages are fixed at 35 cents an hour for men and 30 cents an hour for women with special provisions for apprentices and watchmen. The board of directors of the federation includes the following:

Chairman, H. D. North, president, Ferry Cap & Set Screw Co.; secretary-treasurer, Harry S. Kimball, former president, Remington Arms Co.; R. E. Pritchard, vice-president, The Stanley Works; H. G. Donham, United Shoe Machinery Co.; W. M. Goss, secretary, The Scovil Manufacturing Co.; Alexander Watson, Youngstown Pressed Steel Co.; Wm. D. Disston, Henry Disston & Sons; G. B. Durell, American Fork & Hoe Manufacturing Co.; A. E. Payson, Insulated Container Association; A. M. Ferry, Wire Cloth Manufacturers Association; H. R. Naylor, vice-president, Pressed Metal Institute; A. E. Alverson, president, American Hardware Manufacturers' Association; Arthur E. Swanson, Screw Machine Products Association; D. S. Hunter, trade executive; Irving S. Paull, Institute of Cooking & Heating Appliance Manufacturers, Inc.; Stuart J. Swenson, Aluminum Wares Association, and George P. Byrne, United States Machine Screw Service Bureau.

The federation has a large and diverse membership of trade associations and companies among which are American Cutlery Manufacturers Association, American Gear Manufacturers Association, Automotive Tool & Die Manufacturers Association, Forged Tool Society, Gray Iron Institute, Hack Saw Manufacturers Association, National Association of Manufacturers, National Die & Special Machine Builders Association, Pressed Metal Institute, Screw Machine Products Association, Steel Founders Society of America, Vitreous Enamel Ware Council and the Wrench Institute.

Telephone Manufacturers Accept NEMA Code

Withdrawal of the code submitted to Washington by the telephone manufacturers industry and acceptance by this group of the electrical manufacturing code, approved August 4 by President Roosevelt, will result in the immediate employment of 1,000 persons. This decision was made by units represented by the Telephone Manufacturers Association which includes in its membership such firms as the Stromberg Carlson Telephone Manufacturing Co., Automatic Electric Co., Kellogg Smithboard & Supply Co. and the Lenz Electric Co. The Western Electric Co. has been operating under the electrical manufacturer's code since it became effective.

Goddard to Preside at A.S.M.E. Session

On October 4, the Machine Shop Practice Division of the A.S.M.E. will meet at the Hotel Statler in Detroit in conjunction with the fifteenth annual Metal Congress and Exposition. A. N. Goddard, of Goddard & Goddard, will preside.

C. L. Eksergian, chief engineer of Budd Wheel Co., will present a paper on "Characteristics and Methods of Tests of Automotive Brake Drives." Gordon M. Evans, vice-president in charge of manufacturing, Kelvinator Corporation, will speak on "Simplicity—the Solution of Extreme Accuracy in Quantity Production."

In the afternoon an inspection trip to the Kelvinator plant has been arranged. The A.S.M.E. meeting will be one of twenty technical sessions to be held during the Congress.

British Columbia Potential Machinery Market

Improved conditions now prevailing in the lumber industry in British Columbia afford an excellent opportunity for United States machinery exporters, according to Vice-Consul Nelson P. Meeks, of Vancouver, in a report made public by the Commerce Department. American makers of woodworking and lumbering machinery formerly enjoyed an extensive market in the province.

Because of curtailment in production and lack of funds, numerous British Columbia mills are now operating with inadequate and worn out machinery. If the present trend in price and demand continues these mills will soon be able to purchase new equipment and supplies.

Items likely to be in demand are log carriers, kilns, roller chains, donkey engines, steel belt lacing, swing riggers, conveyors, edgers, resaws and filing room equipment.

NIRA Funds Spur Arsenal Activity

According to a statement by Brigadier General William H. Tschappat, acting chief of ordnance, funds available for the fiscal year ending June 30, 1934 including $6,000,000 received under NIRA, will permit increased activity in arms and munitions manufacture. Rhode Island Arsenal, working on gun mounts, tanks, combat cars, and aircraft artillery, will increase slightly its force of 500 men. Watertown Arsenal engaged in similar work will soon recall the 260 employees it had last year.

Frankford Arsenal will slightly increase its July force of 1,200 men in the manufacture and repair of instruments, small arms, and ammunition. Springfield Armory will continue its force of 350 on small arms and machine guns.

Within a short time, Picatinny Arsenal will be able to return to its normal force of 1,500 from the present 1,050. This unit is engaged in the manufacture of powder and ammunition. Orders for the manufacture of cannon may enable Watervliet Arsenal to increase its present force of 150 men to 200.

British Free-Under-License List Revised

A revised list of types of machinery which may be imported into the United Kingdom duty-free under license has been issued by the Import Duties Advisory Committee, according to a cablegram to the Department of Commerce. The revised list is as follows: Metal-working and finishing, wood-working, agricultural and dairy, battery-making, textile making, finishing and measuring, glass-making and working, electric lamp and radio tube (valve) making, chemical and soap-making and mixing, packaging and labeling, paper and board making and finishing, paper or board products making, embossing and bookbinding, wire-working and wire-winding, tobacco, cigarette and cigar making, food sterilizing and preparing, brush making, furskin dressing, preparing and finishing, and match making machinery.

Presses and machine tools; and

Printers', foundry, testing, and deep oil well machinery.

Applications for licenses for the importation of such machinery should be made, as heretofore, by the purchaser for his own use, or by an importer having an exclusive agency, and may be granted for machinery of types not obtainable in the United Kingdom.

Safety Congress to Meet in October

As a part of the twenty-second annual Safety Congress and Exposition to be held at the Stevens Hotel, Chicago, October 2-6, delegates to the Automotive and Machine Shop and Power Press sections of the National Safety Council will discuss accident prevention.

An average reduction of 24 per cent in the frequency of accidents has been reported by 69 units in the automotive industry employing about 78,000 men. However, there was a sharp increase, nearly 60 per cent, in severity rates. The lowest frequency and severity rates in this group were reported by automobile body plants. Higher rates were made by the groups representing accessories, parts and stampings.

Exports of Machinery During July, 1933

	July, 1933	June, 1933	July, 1932
Electrical machinery	$3,150,456	$3,100,134	$3,065,395
Power generating machinery (except electric and automotive)	322,006	357,732	357,288
Construction machinery	232,181	185,126	339,482
Mining, well and pumping machinery	780,964	782,941	1,210,921
Power-driven metal working machinery	465,702	449,610	604,123
Other metal-working machinery	68,826	81,016	109,090
Textile machinery	468,889	390,735	346,901

Exports of Metal-Working Machinery During July, 1933

	July, 1933	June, 1933	July, 1932
Engine lathes	$11,803	$13,674	$59,023
Turret lathes	13,157	4,744	560
Other lathes	12,228	13,328	48,439
Vertical boring mills	10,045	10,925	7,494
Thread-cutting and automatic screw machines	22,135	30,491	898
Knee and column type milling machines	6,543	3,409	16,234
Other milling machines	12,741	13,573	2,996
Gear cutting machines	51,336	31,872	23,525
Radial drilling machines	8,694	....	17,330
Vertical drilling machines	38,683	14,443	2,283
Other drilling machines	18,008	20,431	9,557
Planers and shapers	1,150	4,500	6,438
Surface grinding machines	4,060	11,132	16,836
External grinding machines	3,998	15,164	7,483
Internal grinding machines	12,360	4,742	12,919
Tool grinding, cutter grinding and universal grinding machines	19,568	24,937	11,257
Other metal-grinding machines	19,624	12,665	16,035
Sheet and plate metal-working machines	37,640	41,697	128,992
Forging machinery	34,118	17,712	61,668
Rolling mill machinery	23,913	48,999	9,247
Foundry and molding equipment	11,400	17,748	29,087
Other power-driven metal-working machinery and parts	92,228	93,424	115,822

Other Metal-Working Machinery

Pneumatic portable tools	19,853	24,574	15,396
Other portable hand-operated machines and parts	17,309	18,265	22,471
Chucks for machine tools	3,920	3,127	3,544
Machine-operated pipe and thread cutters, stocks, dies, taps and other machine-operated cutting tools	16,320	21,213	45,308
Other metal-working tools	11,424	13,837	22,371

October 4 is the date of the session of the Automotive and Machine Shop section with J. C. Wilson, vice-president, Lumbermen's Mutual Casuality Co. presiding. Address will be made by M. J. McCarthy, Fisher Body Corporation, on "Past, Present and Future of the Automotive and Machine Shop Section," A. Rosseau, Norton Co., on "Safe Construction, Installation and Operation of Grinding Wheels," H. L. Sain, representing the Ohio Industrial Commission, on "Safety in Machine Shops under 1933 Conditions," and Merle C. Hale, General Motors Corporation.

Two sessions will be held by the Power Press Section. E. J. Smith, Western Electric Co., will preside at the first. Speakers will be A. L. Kaems, safety engineer, Simmons Co., on "Trend of Accidents in the Metal Trades Industry," William A. Janzer, Seaman Body Corporation, on "The Safe Operation of Portable Pneumatic Tools," and J. Leonard Juhl, general superintendent of planning, the Murray Corporation on "Importance of Inspection in the Press Room."

At the second Power Press session, to be held on October 5, Thomas P. Kearns, superintendent of Hygiene and Safety of the Industrial Commission of Ohio, will speak on "Selling Safety to Workers in the Metal Trades," and J. A. Voss, safety director, Republic Steel, Corp., on "Elimination of Unsafe Practices."

The Power Press section reports that in seven different groups, representing 282 industrial units and 150,000 employees, frequency of accidents declined 15 per cent while the severity rate was reduced 3 per cent. Large plants had less than half the number of accidents of the small plants but severity rates were nearly twice as great.

• BUSINESS ITEMS •

JOHN E. MINTY, works manager of the Shaw-Box Crane & Hoist Co., Inc., Muskegon, Mich., has been made general manager. He has been connected with the company in various positions for the past twelve years.

The Landis Tool Co. is conducting an exhibit and demonstration at its Chicago office, 618 West Washington Blvd. A Type C 6 x 18 in. plain hydraulic grinder equipped with a new air-sizing device and a 12 x 32 in. tool and cutter grinder are under power.

Simmons Manufacturing Co., Cleveland, Ohio, manufacturer of automotive parts and accessories, has purchased the plant of the Superior Screw & Bolt Manufacturing Co., and will occupy the plant at once.

The Remington Arms Co., Bridgeport, Conn., has acquired the Chamberlain Cartridge & Target Co., Findlay, Ohio, through an outright purchase.

The General Electric Co. and four of its associated companies have moved their New York offices to the new General Electric Building, 570 Lexington Ave., at 51st St. The former headquarters were at 120 Broadway.

The Allsteel Press Co., Chicago, manufacturer of the Verson Allsteel line of punch presses and sheet metal working machinery, has appointed E. H. MERRICK, Cook Bldg., Cleveland, Ohio, exclusive representative in the Cleveland district.

• PERSONALS •

JOSEPH L. MCCLANE has been appointed factory manager of the Chance Vought Corp., East Hartford, Conn., to succeed JAMES N. DEAN. Mr. McClane entered aviation in 1917 as an engineer in the original organization of the Army Air Service. He became connected with the Chance Vought Corporation in 1930.

FRED R. ERBACH, chief engineer of the General Refrigeration Co., Beloit, Wis., has been made vice-president and general manager.

CHARLES H. GARITY has been appointed director of purchases and procurement by the Tennessee Valley Authority.

DR. JEROME CLARKE HUNSAKER, vice-president of the Goodyear Zeppelin Corp., and internationally known for his contributions to aeronautical engineering, has accepted appointment as head of the department of mechanical engineering, Massachusetts Institute of Technology.

GEORGE B. KARELITZ has resigned as manager of the marine engineering division of the Westinghouse Electric & Mfg. Co., South Philadelphia Works, to become professor of mechanical engineering at Columbia University, and to engage in consulting practice.

CHARLES F. NORTON, formerly with the Howell Electric Co., Howell, Mich., as vice-president and general manager, has joined the Allis-Chalmers Co., in an executive sales capacity.

H. W. THORNE has been elected president and treasurer of the Holland Furnace Co., Holland, Mich., succeeding C. H. LANDWEHR. P. T. CHEFF is vice-president in charge of production.

The Bantam Ball Bearing Co., has appointed H. E. EWART as Pittsburgh district representative on steel mill and industrial bearing applications. For several years Mr. Ewart was assistant chief engineer of the United Engineering & Foundry Co.

• OBITUARIES •

BURTON C. SMITH, LaCrosse, Wis., died at the age of 64. He established the farm equipment business of the Smith Manufacturing Co.

W. E. DOWD, JR., 54, vice-president of the Foster-Wheeler Corp., died Aug. 14. He is said to have been associated with the corporation for 27 years.

J. HOWARD MUZZY, chairman of the board, Federal Mogul Corp., Detroit, Mich., manufacturer of bearings, died on Aug. 9. He helped form the Muzzy-Lyon Co., Ltd. in 1919, this company being merged in 1924 with the Federal Bearings & Bushing Corp. to form the Federal Mogul Corp.

AUGUST F. SCHOEN, president, general manager and founder of the National Sherardizing & Machine Co., Hartford, Conn., died Aug. 16, aged 55. He was formerly connected with the Stanley Works, New Britain, and the New Haven Sherardizing Co., organizing the latter company in 1909. In 1919 the company was incorporated as the National Sherardizing Co.

JOHN H. WATERS, president of the National Radiator Corp., died Aug. 11, aged 74.

• MEETINGS •

NATIONAL ASSOCIATION OF FOREMEN. Annual convention. September 15-16. Akron Ohio. E. H. TINGLEY, secretary. Refinery Bldg., Dayton, Ohio.

NATIONAL METAL CONGRESS AND EXPOSITION. October 2-6. Detroit, Mich. Under the auspices of the American Society for Steel Treating. W. H. EISENMAN, secretary, 7016 Euclid Ave., Cleveland, Ohio.

NATIONAL SAFETY COUNCIL Twenty-second annual safety congress and exposition. October 2-6. Stevens Hotel, Chicago. National Safety Council, Civic Opera Bldg., 20 North Wacker Drive, Chicago.

SOCIETY OF AUTOMOTIVE ENGINEERS. International automotive engineering congress. August 28-September 4. Palmer House, Chicago. JOHN A. C. WARNER, general manager and secretary, 29 West 39th St., New York, N. Y.

American Machinist
REFERENCE BOOK SHEET

Machining Non-Metallic Materials—I

General

Tungsten-carbide tools are preferred for machining Formica, Micarta and Textolite because these materials are abrasive. High-speed steel tools are frequently used for small-quantity work, but carbon steel tools are not employed. Diamond tools are rarely used. Coolant is seldom applied, but an air blast has some cooling effect for drilling operations and is useful in removing chips and dust in this and other operations.

Formica

Formica is a laminated gear material made by the Formica Insulation Co., Cincinnati, Ohio. The material is made of cotton duck impregnated with a phenolic resin.

TURNING. The outside diameter and sides of gear blanks are turned with the tools illustrated. Such tools must have 3 to 5 deg. more rake and clearance than is common for metal turning tools. Speeds up to 750 ft. per min. can be used successfully. Cut can be from $\frac{1}{32}$ to $\frac{1}{8}$ in., but the feed should be 0.030 in. regardless of the cut. The cut should overlap the feed. Provision should be made in grinding the tools so that they clear themselves.

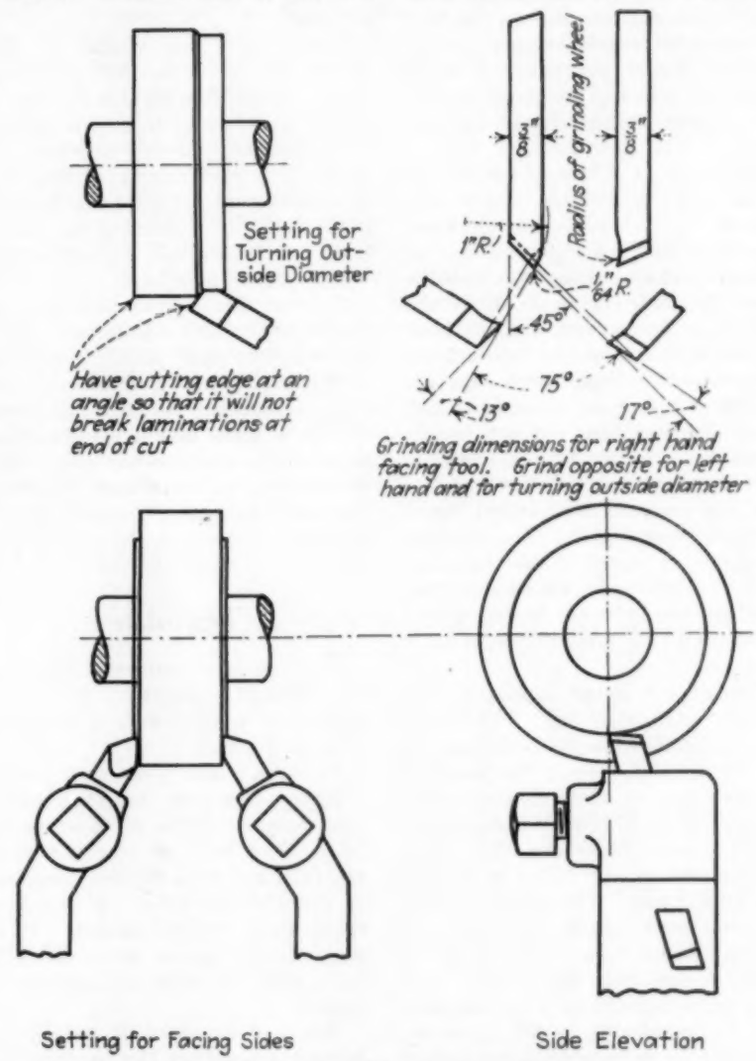
THREADING. Chasing tools require special rake and clearance from 3 to 5 deg. more than is common practice with metal. Dieheads do not require special rake and clearance. They are operated at a relatively slow speed and are backed off a short distance in every inch of threading. Neither taps nor dies require special grinding. High speed and ground taps produce the best results. Tap drill sizes recommended are the same as those commonly used for metal.

DRILLING. The cutting point of the drill should have an included angle of about 55 deg. Rapid feed prevents the drill from lagging. For holes more than ½ in. deep the drill should be withdrawn momentarily to cool and remove the chips. The mimimum preferred speed is 1,200 r.p.m.

GEAR CUTTING. Teeth may be cut on a hobbing or milling machine or a shaper. Assuming a 3-in. hob with 10 teeth the speed would be 150 ft. per min. and the feed from 0.090 to 0.110 in. per revolution.

Micarta

Micarta is a product of the Westinghouse Electric & Mfg. Co. It is made of either a paper or fabric base


Setting for Turning Outside Diameter
Have cutting edge at an angle so that it will not break laminations at end of cut
Radius of grinding wheel
1"R.
1" 64 R.
45°
75°
13°
17°
Grinding dimensions for right hand facing tool. Grind opposite for left hand and for turning outside diameter
Setting for Facing Sides
Side Elevation

Tools for turning Formica gear blanks

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REFERENCE BOOK SHEET

Machining Non-Metallic Materials—I

and a synthetic resin. The data following are from the company's experience.

TURNING. In general, high speeds, fine feeds and light cuts are best. If high-speed steel tools are used the speed should be from 100 to 125 ft. per minute. Where roughing and finishing cuts are taken, a high-speed steel tool is not essential for the first operation but should be used for the second. About 0.010 in. of stock should be left for the finishing cut. An exhaust system should be provided.

THREADING. Chasers should be made without the hook used in cutting steel. Plenty of chip clearance should be used on taps and dies as Micarta has a tendency to choke the tap. No undercut or hook on the flute is necessary, but a slight hook on the lead is required to start the chip to curl. High speed taps are preferred except in extremely small sizes. Ground taps are not usually necessary. About 70 per cent full thread is recommended. Standard tap drill sizes are satisfactory. Small holes (under ¼ in.) are machine tapped at a speed of 200 r.p.m. or under. Larger holes are hand tapped. Medium-size holes are tapped with a slow-speed drill press fixture at 40 to 60 r.p.m.

DRILLING. Acute angle of drill should be 49 to 50 deg. The face of the lip should have the hook removed as for cutting brass. The grade of Micarta has an effect on the cutting speed and feed. For Micarta with a cloth or paper base holes up to ¼ in. in diameter can be drilled at a speed of 1,600 r.p.m. The asbestos grade requires slower speeds of 800 to 1,000 r.p.m. Holes from ¼ to ⅝ in. require speeds from 500 to 800 r.p.m. For holes from ⅝ to 1 in. the speed should be from 80 to 200 r.p.m. and above 1 in. in diameter a counterbore should be used. Use hand feed. On small holes and thin material a feed suitable for wood can be used. When drilling straight through on thick material it is necessary to clear the drill about every ½ in.

MILLING. A standard cutter may be used at a speed and feed corresponding to those used for bronze or soft steel.

PUNCHING. Dies should be designed the same as for punching metal, except that smaller clearances should be allowed. In cold punching it is desirable that this clearance be small and approach a sliding fit. Maximum punching thickness for any grade is ⅛ in. Heating the stock from 100 to 120 deg. C. will assure better quality punching.

SAWING. Material up to 1 in. thick should be cut with a 10-in. saw working at 3,000 r.p.m. Above 1 in. thick a 16-in. saw running at about 1,600 r.p.m. is satisfactory. Roughing cuts should be made with a saw having a bevel tooth, seven to the inch, while for finishing a smooth saw similar to that used for metal (no set) should be used.

Textolite

Textolite is a product of the General Electric Company. It consists of canvas coated with a synthetic resin as a binder.

TURNING. The tools used by the company comprise tungsten-carbide tips mounted on ⅜- or ⅝-in. square bits. These tools are ground with no top rake and with 6½ deg. clearance on the end and sides. A very keen edge must be maintained. When tools become too dull to cut Textolite they will still work satisfactory on metals.

The cutting speed is usually the highest speed that the machine will handle, up to 500 or 600 ft. per min. Roughing cuts range from ⅛ to ⅛ in., finishing cuts not less than ⅛ in.

THREADING. The rake and clearance on chasing tools are the same as those used on turning tools. Special grinding is not necessary for taps and dies. High-speed ground taps have been found to give the best results. Tap drill sizes are the same as those used for steel. Most work is tapped by hand. For production tapping it is recommended that a coolant of very light oil or turpentine be used.

DRILLING. Best results are obtained with twist drills having a long lead and with the lips ground thin and with little rake. An air blast is used to cool the drill. Most drilling work is done with hand feed. For a ⅜-in. drill the speed is 1,800 r.p.m. With automatic feed, using a No. 45 drill operating at 3,600 r.p.m., a feed per revolution of 0.002 to 0.003 in. has been found satisfactory.

PUNCHING. Textolite may be punched readily in thicknesses up to ⅛ in. The die should be relieved on a taper of about ¼ deg. to a distance of ⅛ in. below the surface. This relief will minimize splitting around the edge of the punched part. Punched holes usually contract slightly, so that it is necessary to make punches slightly larger than the hole desired. The increase in punch diameter is equal to aproximately 3 per cent of the thickness of the material. When thick pieces are being punched, it is desirable to use a shaving die.

Some grades of Textolite can be punched cold, but it has been found by some manufacturers to be worthwhile to heat all material before punching. This is usually done by laying the strips on a steam plate which should not have a temperature higher than 300 deg. F. The Textolite should not be left on the plate for an extended period.

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The Small Shop Scrap Pile

FRED H. COLVIN

Editor, American Machinist

Scrap piles get to be a real problem in the small shop. Small stuff, such as cut-off ends from bars, old gears and odds and ends of all kinds, are thrown into a box, which is frequently known as the "hell box." The name, according to some old timers, is most appropriate because "it's a heluva job to find anything you want, even when it's there." And this is the greatest reason for studying the scrap pile or the scrap box as a problem.

There is no doubt that the small shop can frequently save dollars by utilizing parts from the scrap pile or box. It is also true that in many cases the time spent in finding the piece that can be used costs more than the saving. And when the search fails to discover anything that can be used, the time spent is a total loss. So we have those who save everything and those who save nothing, both believing they have the right idea. As in most cases, there is usually a middle ground that gives the best average result.

The scrap pile fanatic spends hours in digging out pieces that can be used and then tells you how material didn't cost him a cent. But he forgets to charge up his time as material cost. And the chances are that he uses parts which are not well suited to the job, to make his point. There may be times when time is less valuable than even a small amount of cash, but that is an abnormal condition.

Scrap material can be either an asset or a liability, depending on the way it is handled. If it is simply dumped in a pile or box as it comes, with no way of knowing what is there, it is a liability. It will be money in pocket to sell it for junk at frequent intervals instead of trying to use it at all.

If, on the other hand, it can be stored in some kind of order so that parts most likely to be needed can be readily found, the scrap pile can be an asset. As with all other phases of small shop management, it requires real brains to decide on the right method.

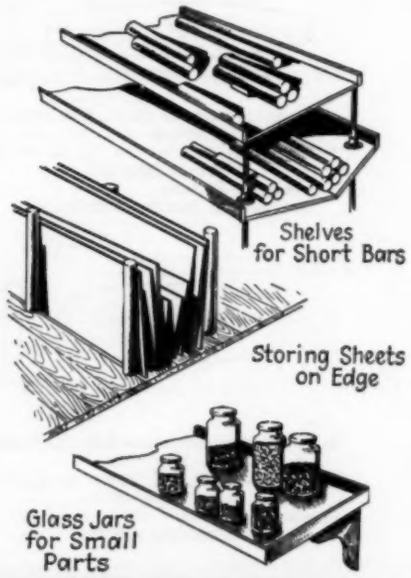
Just how scrap can best be kept depends on the kind of material, its size, and the frequency with which it may be needed. Pulleys, gears or parts that run into money should be kept in sight if possible. If not, it might pay to keep a note of them on cards, in a book or in any way that is most convenient. Two minutes making a note may save an hour when you need a piece in a hurry. Rough racks and bins can be made to hold bars or sheet.

Something on the order of a trough holds short pieces of bar very well. Where flat shelves are used, small wedges keep bars from rolling. Sheet should be stored on edge in most cases, and if the pieces can be sorted both by thickness and approximate size, they can be found with little trouble. Safety also makes it advisable to store sheets rather carefully as it is easy to get painful, and even dangerous cuts, from pawing over a mass of scrap sheet metal.

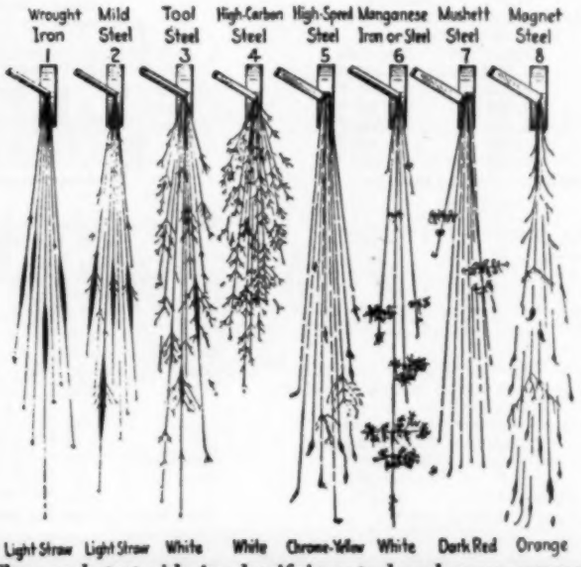
Kinds or grades of material should also be plainly marked, especially when a mistake might easily cost dollars, as in making up tools from the wrong steel. This caution as to kinds of material applies to new material. No elaborate classification is necessary, simply enough to keep from getting into trouble. And if there is any doubt as to a piece, don't use it. Buy a new piece. This business of sorting steels also makes it advisable to use as few grades as seems consistent with economy and good results.

If you want to buy new materials (and who doesn't?) keep them separate from regular stock. And while the spark test isn't infallible, it's a good thing to know about and use when occasion demands. It isn't new, but was brought out by John F. Keller of Purdue and is reproduced herewith for your convenience. It's a good thing to use when in doubt.

The more scrap you keep the more it costs to handle it, the more room it takes, and the less likely you are to find what you need, unless it is carefully sorted. Keeping the scrap pile as small as possible is always advisable. When in doubt as to keeping an old piece—don't. Of course you may need it the next day. But if you check up on the number of times you handle an odd piece that doesn't fill the bill, it would have been cheaper to throw it away. To the few dollars you get from the junk man you can add what you have saved in floor space and in handling time.



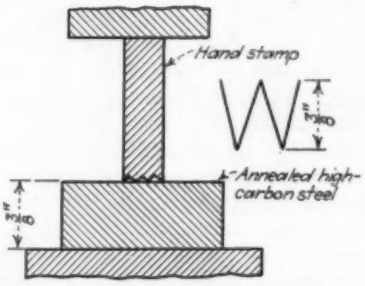
Material is quickly found when it is neatly and appropriately stored



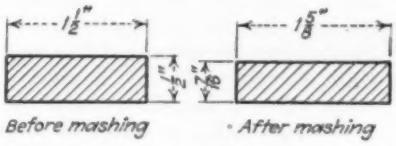
The spark test aids in classifying steel and saves expense of trying to use the wrong kind

Press Work Pressures

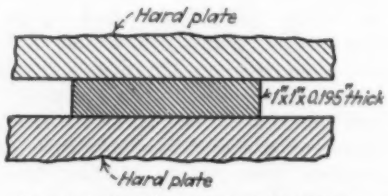
Series XIV—*Coining*



Material--Annealed high carbon steel
Operation--Stamp letter "B" with ordinary hand stamp, 1/64 in. deep
Pressure--16,000 lb. or 10,667 lb. per lineal inch
Soft steel 1/16 in. thick required 8,000 lb. per lineal inch
Test made in testing machine



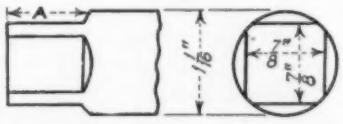
Material--Copper disk ½ in. thick by 1½ in. in diameter, annealed
Operation--Reduce thickness from ½ in. to 7/16 in.
Pressure--47 tons Not annealed
38 tons Annealed
Test made in testing machine



Material--Machine steel, 1x1x0.195 in. thick, not annealed
Operation--Reduce thickness as shown in table

Reduction	Pressure
0.0005 in.	30,000 lb.
0.002 "	40,000 "
0.004 "	50,000 "
0.009 "	60,000 "
0.014 "	70,000 "
0.016 "	80,000 "

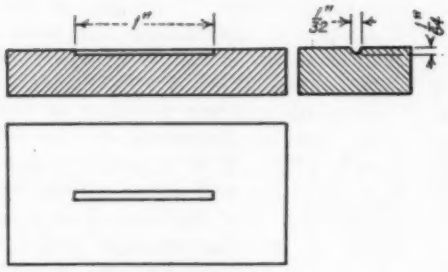
Test made in testing machine



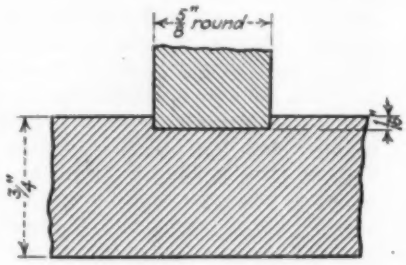
Material--Cold-rolled steel stay-bolt
Operation--Coin square end on 1-1/16 in. round bolt

Pressure--Dimension A	Pressure
1/4 in.	19½ tons
1/2 "	37½ "
3/4 "	50 "
1 "	70 "

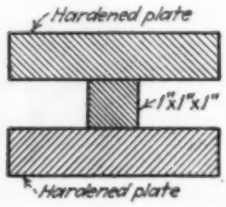
Test made in testing machine



Material--A-Soft brass,
B-Half-hard brass
C-Hard brass
Operation--Coin groove 1 in. long by 1/32 in. wide by 1/64 in. deep
Pressure--A-3,000 lb., B-6,000 lb., C-6,100 lb.
To indent groove 1 in. long by 1/64 in. wide by 1/128 in. deep, hard brass, 1/32 in. thick, required 1,000 lb.
Hard aluminum 0.041 in. thick required 1,000 lb.
Test made in testing machine



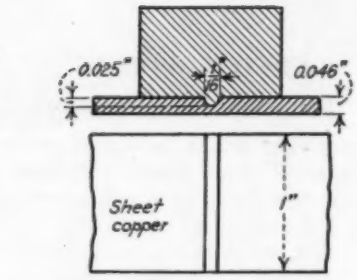
Material--Soft machine steel plate, 6 in. long x 3 in. wide x ¾ in. thick
Operation--Sink 5/8 in. diameter punch 1/16 in. deep
Pressure--50,000 lb.
Test made in testing machine



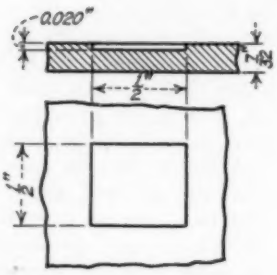
Material--Annealed machine steel, 1x1x1 in. Annealed.
Iron, 1x1x1 in.
Operation--Mash in various amounts

	Reduction	Pressure
	1/32 in.	52,800 lb.
	1/16 "	69,300 "
Machine	3/32 "	82,700 "
Steel	1/8 "	91,000 "
	5/32 "	100,200 "
	1/32 in.	52,800 lb.
	1/16 "	62,700 "
Annealed	3/32 "	71,600 "
Iron	1/8 "	79,000 "
	5/32 "	89,000 "

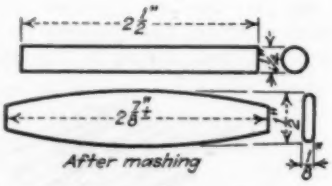
Test made in testing machine



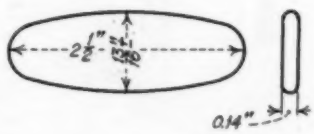
Material--Sheet copper, 0.046 in. thick
Operation--Coin a groove
Pressure--3½ tons
Test made in testing machine



Material--Hard (0.85 carbon) steel, 7/32 in. thick
Operation--Indent a ½ in. square - 0.020 in. deep
Pressure--120 tons per sq. in.
Test made in testing machine



Material--Machine steel, ½ in. in diameter
Operation--Mash to 1/8 in. in thickness. Done hot
Pressure--25 tons
Test made in testing machine



Material--Machine steel 3/8 in. diameter, 2 in. long
Operation--Mash to 0.14 in. in thickness. Done hot
Pressure--25 tons
Test made in testing machine

Contributed by C. W. LUCAS

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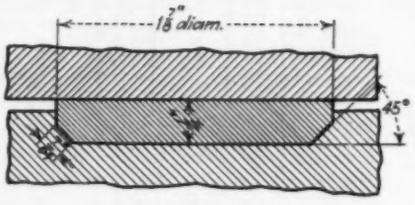
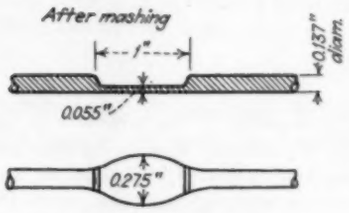
Press Work Pressures

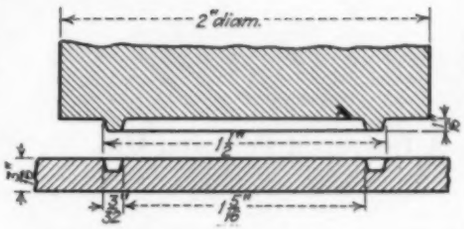
Series XIV—*Coining*



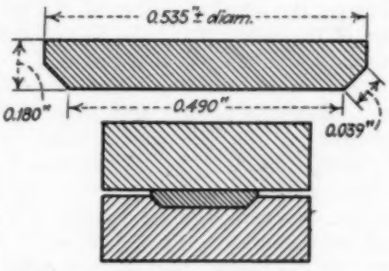
Material--0.50 to 0.60 carbon steel, round blank ¼ in. thick
Operation--Coin a bevel of 45 deg.
Pressure--80,000 lb.
50,000 lb. required to bevel a blank 15/16 in. in diameter by 3/16 in. thick
Test made in testing machine



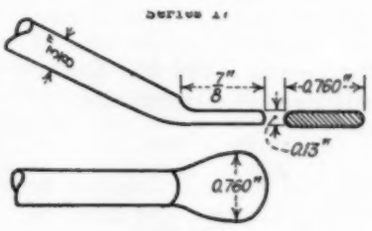
Material--Soft steel wire, 0.137 in. in diameter
Operation--Mash 1 in. as shown
Pressure--69,000 lb.
Test made in testing machine



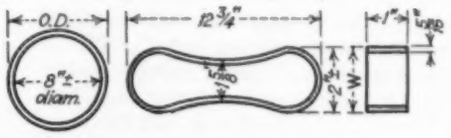
Material--Machine steel 3/16 in. thick
Operation--Sink circular groove 1/16 in. deep
Pressure--100,000 lb.
Test made in testing machine



Material--0.50 to 0.60 carbon steel, 0.180 in. thick
Operation--Coin 45 deg. bevel
Pressure--10,000 lb.
Test made in testing machine



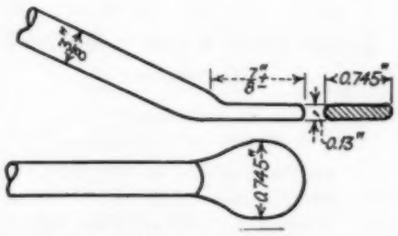
Material--Machine steel, 3/8 in. in diameter
Operation--Mash 7/8 in. length to a width of 0.760 in.
Pressure--43½ tons
Test made in testing machine



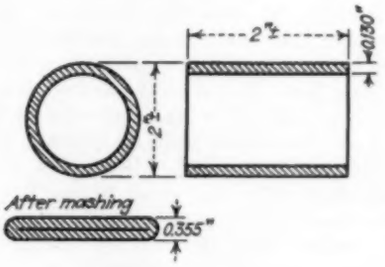
Material--Machine steel ring, 5/16 in. thick
Operation--Mash to widths given in table

Diameter	O.D.	Pressure	Width-W
8 in.	8-5/8 in.	1,000 lb.	6 31/32 in.
8 "	8-5/8 "	1,400 "	5 5/16 "
8 "	8-5/8 "	1,700 "	3 21/32 "
8 "	8-5/8 "	3,900 "	2
12 "	12-7/8 "	1,000 "	10 3/16 "
12 "	12-7/8 "	1,200 "	7 7/16 "
12 "	12-7/8 "	1,950 "	4 3/4
12 "	12-7/8 "	6,700 "	2

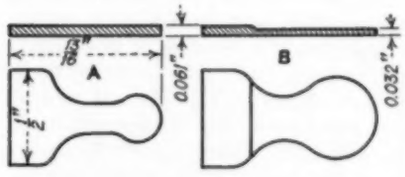
Test made in testing machine



Material--Machine steel, 3/8 in. in diameter
Operation--Mash 7/8 in. length to width of 0.745 in.
Pressure--40½ tons
Test made in testing machine

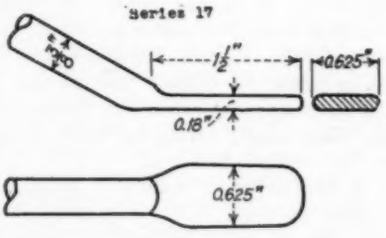


Material--Mild steel boiler tube, 0.130 in. thick
Operation--Mash 2 in. long tube, flat
Pressure--15,000 lb. 2 in. long
80,000 lb. 9½ in. long
Test made in testing machine

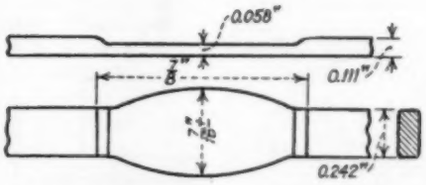


Material--Soft machine steel, (0.15 carbon) 0.061 in. thick
Operation--Coin A to B
Pressure--60,000 lb. To mash the entire surface of A to a thickness of 0.0325 in. required 70,000 lb.
Test made in testing machine

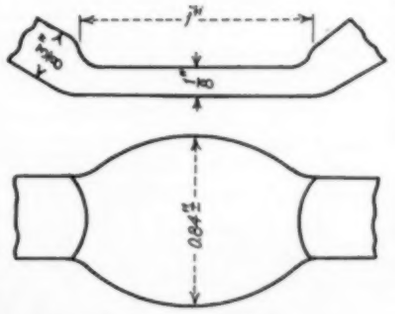
Series 17



Material--Machine steel, 3/8 in. in diameter, un-annealed
Operation--Mash 1½ in. length to width of 0.625 in.
Pressure--50 tons
Test made in testing machine



Material--Machine steel, 0.111 in. thick
Operation--Mash 7/8 in. portion to 0.058 in. in thickness
Pressure--48,000 lb.



Material--Machine steel, 3/8 in. in diameter
Operation--1 in. mashed to 1/8 in. in thickness. Done hot
Pressure--25 tons
Test made in testing machine

Contributed by C. W. LUCAS © *American Machinist*

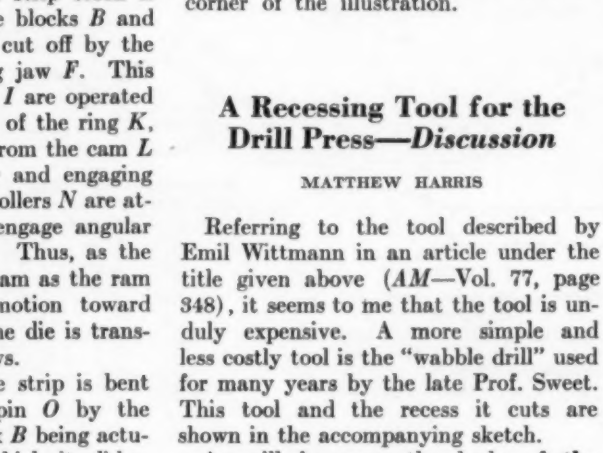
IDEAS FROM PRACTICAL MEN

A Universal Forming Die

CHARLES KUGLER

In the illustration is shown a die in which thin, soft copper or brass is cut from a strip and is formed to the shape at *A*. In operation, the strip stock is fed by hand between the blocks *B* and *C* to the stop *D* and is cut off by the sharp edge of the sliding jaw *F*. This jaw and the jaws *H* and *I* are operated by the oscillating motion of the ring *K*, which motion is derived from the cam *L* held in the punch-holder and engaging the slot *M* in the ring. Rollers *N* are attached to the ring and engage angular slots in the sliding jaws. Thus, as the ring is oscillated by the cam as the ram descends and ascends, motion toward and from the center of the die is transmitted to the sliding jaws.

The piece cut from the strip is bent into U-shape over the pin *O* by the forming block *P*, the block *B* being actuated by the jaw *F* in which it slides, the coil spring *S* keeping it in contact with the stock. After the piece has been bent into U-shape, the jaws *H* and *I* bend the legs of the U toward each other and flatten them against the under side of the pin *O*. When the ram is at the top of its stroke and the sliding jaws have been withdrawn to their outermost position by the action of the cam, the operator removes the finished piece with duckbill pliers, one jaw of which is inserted in the groove *T* in the pin *O*. By the use of forming pins and forming blocks of the proper shapes, and by making some minor changes in the sliding jaws, pieces can be formed to a variety of shapes, some of which may be seen at *W* in the upper right-hand corner of the illustration.



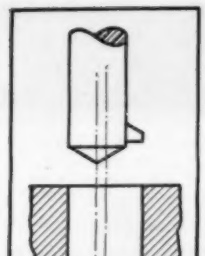
With some miner changes, this die can be used to form a variety of shapes

A Recessing Tool for the Drill Press—*Discussion*

MATTHEW HARRIS

Referring to the tool described by Emil Wittmann in an article under the title given above (*AM*—Vol. 77, page 348), it seems to me that the tool is unduly expensive. A more simple and less costly tool is the "wabble drill" used for many years by the late Prof. Sweet. This tool and the recess it cuts are shown in the accompanying sketch.

As will be seen, the body of the "wabble drill" is enough smaller than the hole to permit the entrance of the cutting lip. The tool is lowered into the hole without being revolved and is not set in motion until it bottoms at *A*. Since the "point" of the tool is not concentric with the center of the hole, the rotary action causes the cutting lip to contact with the wall of the hole for less than its circumference, springing the tool and causing it to wabble; hence its name. As downward pressure is applied to the tool, the conical point slides on the angular surface at the bottom of the hole toward the center, cutting and wabbling as it slides.



The conical point forces this undercutting tool into the work

Under continued downward pressure, the tool springs further until it is finally centered in the conical depression at the bottom of the hole. When centered, it cuts a recess having a radius equal to the distance from its center to the end of the cutting lip. The sectional view in the lower part of the sketch shows the recess. "Wabble drills" should be as long as is possible so that the springing action will create the least strain.

Tools That Were a Failure *Discussion*

R. F. MOORE
Moore Special Tool Company, Inc.

At the end of his article under the title given above (*AM*—Vol. 77, page 284), Forrest L. Johnson asks how the reader would attack the problem of making the hooks in mass quantities.

Judging from the way Mr. Johnson went at the matter he would be satisfied with any fast hand-feed attachment. Therefore, I should think he would form the hooks in a power press equipped with a feed dial. In such a press the hooks could be formed just as fast as the operator could feed the blanks into the dial, which would be fully as fast as the method he tried.

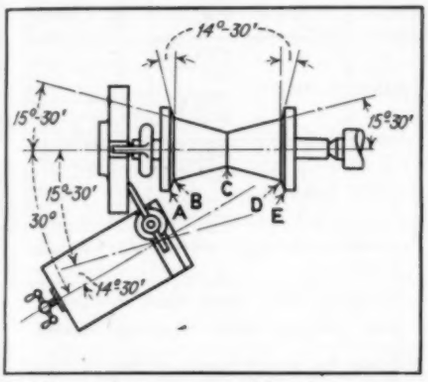
If Mr. Johnson wished to go a step farther, he could rig up a magazine feed. The blanks could be stacked vertically and be picked off of the bottom by an automatic finger operated from the crankshaft or other moving part of the press. This would probably be faster than feeding by hand. It is just a question as to whether or not the quantity to be made would warrant the extra cost of rigging up a magazine.

Setting Tools Without Gages

WILLIAM S. ROWELL

Many are the schemes for setting tools in lathes, planers, shapers, etc. Even sets of setting gages are advocated by some machinists. Some years ago I got almost entirely away from using gages for setting tools, even for thread cutting I seldom use the well-known center gage to set the tool.

In cutting right-hand threads, nearly all live lathe hands set the compound rest at or near 30 deg. to the right. Since the depth if cut is controlled by feeding the tool by the compound rest, the left-hand side of the thread flank is produced by the set given the tool, while the right-hand side is produced by the angular travel given the tool by the compound rest. To set



Using the compound rest to get the desired angles without gages

the tool without a gage, the compound rest is swung 60 deg. to the right and the tool is brought against the faceplate and adjusted so that its left-hand side is parallel thereto. The compound rest is then swung 30 deg. to the left, bringing the tool into the correct position for cutting the thread. This method can be used for setting tools at an angle in shapers, planers and other machines having toolholders graduated in circles from their pivots.

Another, but slightly different application of setting a tool without a gage is shown in the illustration. Suppose it is required to turn a piece to the shape indicated by the lines *ABCDE*, where the dimensions of *AB* and *DE* are short enough to be cut without traveling the tool. To produce this shape, the tool is set to the faceplate when the compound rest stands at 60 deg. to the left, or 30 deg. to the center line of the spindle. The compound rest is then swung 14 deg. 30 min. farther to the left, or to an angle of 74 deg. 30 min., making its line of travel 15 deg. 30 min. to the center of the lathe spindle.

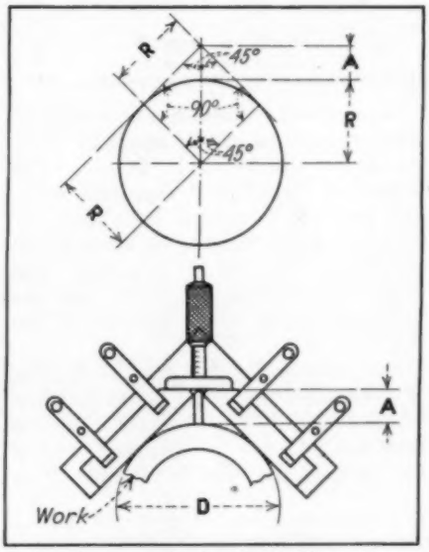
With the compound rest so set, the flange *AB* can be turned either by feeding the tool straight in by the crossslide or by traversing the carriage, or by a combination of both movements. The part *BC* is turned by feeding the tool with the compound rest. When the cut has reached *C*, the lathe is stopped, the work is turned end for end and the other half is finished by a repetition of the former method.

Finding the Diameter Where the Center Is not Accessible Discussion

EMIL WITTMANN

The article by Paul C. Bruhl under the title given above (*AM*—Vol. 77, page 184) is interesting and reminds me of a simple device that I have occasionally used for the same purpose.

To a flat square of suitable size are clamped two parallels. One end of each parallel is machined to a bevel of 45 deg. to form a base on which to rest a



Another method of finding the diameter of a broken circle

micrometer depth-gage, as may be seen in the lower part of the illustration. The accuracy of the device is checked by placing it on a cylindrical piece of known diameter.

The reading of the distance *A* must agree with the value derived from the equation $A = \frac{D}{4.8285}$ as follows:

$$\sin 45 = \frac{R}{R+A}$$

$$\sin 45^\circ (R+A) = R$$

$$\sin 45^\circ R + \sin 45^\circ A = R$$

$$R - \sin 45^\circ R = \sin 45^\circ A$$

$$R (1 - \sin 45^\circ) = \sin 45^\circ A$$

$$R = \frac{\sin 45^\circ A}{1 - \sin 45^\circ} = \frac{0.70711 A}{1 - 0.70711} = \frac{0.70711 A}{0.29289} = 2.41425 A$$

$$D = 2 R = 4.8285 A$$

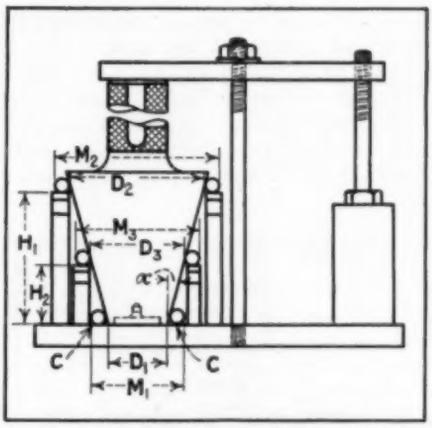
Measuring a Taper Plug Gage

A. J. WORMWOOD
Independent Pneumatic Tool Company

A most satisfactory way of measuring a taper plug gage is the one recommended by the U. S. Bureau of Standards.

The gage is rough turned on centers, using the taper attachment for the angle and the micrometer for the diameters. The small end is then counterbored, as shown in the illustration. After hardening the gage, the face of the small end is ground square with the center line and a trial cut is taken over the body in the grinder. After the trial cut, the gage is clamped on a surface plate with the small end down.

A micrometer measurement M_1 is then taken over two accurate cylinders *C* of equal diameter, which rest upon the surface plate and are in contact with the gage near the small end. A second measurement M_2 is taken near the large end with the cylinders resting upon gage blocks H_1 of equal height. A check measurement M_3 may be taken with the cylinders resting upon the gage blocks



A gage checked by this method will be accurate

H_2. Comparison of these three measurements with the required finished diameters at these points will show the approach to the correct taper and diameters.

The required dimension at M_1 is found as follows:

$$M_1 = D_1 + G [1 + \cot \tfrac{1}{2} (90 \text{ deg.} - \alpha)]. \quad (1)$$

in which *G* equals the diameter of the cylinders.

The required dimensions

$M_2 = M_1 + 2 (\tan a \times H_1)$ and (2)

$M_3 = M_1 + 2 (\tan a \times H_2)$ (3)

If H_2 is made equal to one-half of H_1, M_2 will be equal to M_1 increased by one-half the difference between M_1 and M_3.

When the difference between the test measurements M_1, M_2 and M_3 is the same as the difference between the required dimensions at those points, the gage has the correct taper and may then be finished to size.

To determine the taper and the diameters of a finished, taper plug gage, take measurements M_1 and M_3. For convenience in computing, have H_1 an even number of inches. Divide one-half the difference between these measurements by the height H_1 to find the tangent of the angle of taper, as measured on the center line.

Formula 1 will give a constant, which subtracted from M_1 and M_3 will give the actual diameters of D_1 and D_3. The same procedure may be followed with the check measurement M_2.

Press Tools for Felt Retainers

JOHN JERGENS

Blanking, forming and piercing operations are performed on felt retainers by the pillar-press tools illustrated.

In operation, the strip stock is fed under the stripper *A*, across the top of the die and against the stop pin *B* in Fig. 1. As the ram descends, the part is blanked, and as the ram continues its downward movement the part is first-formed, as indicated by the heavy line. The spring-actuated pad *C* ejects the part from the die. In case it should stick to the punch, the spring-actuated knockout pin *D* will strip it. The tools in Fig. 2 are for the second forming. Here the part is turned upside down in the die and is completely formed with the exception of bending over the vertical flange to complete the groove.

The tools in Fig. 3 bend over the flange, completely forming the groove and pierce the central hole. The part is placed in the nest *A*, in which it is held by the spring-actuated guide and stripper *B* as the ram descends. Continued downward movement of the ram causes the punch *C* to pierce the central hole. As the ram nears the bottom of its stroke, the angular end of the forming punch *D* bends over the flange and completes the groove. As the ram ascends, the part is stripped by being held in the nest by the combination guide and stripper until the punch has cleared it. When the ram reaches the top of its stroke, the combination guide and stripper has been raised far enough to permit the part to be lifted out of the nest.

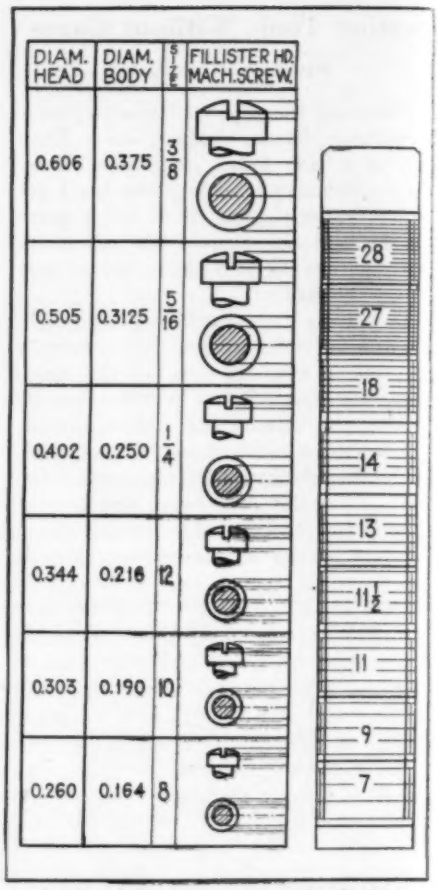
Kinks for Draftsmen

VICTOR H. KIDNEY
Chief Draftsman,
Fourness Development Corporation, Ltd.

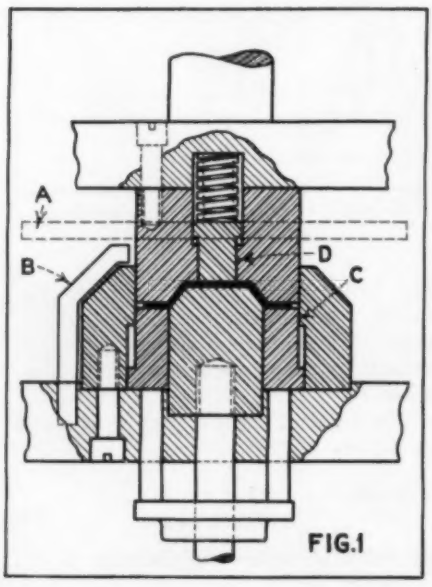
In drawing fillister-head screws in place, much time can be saved by using the device illustrated in Fig. 1. The original is etched on transparent celluloid, and the projection lines serve for transferring the heights of screw heads of different sizes to the drawing. The diameters of both the heads and the bodies are given in the columns at the left.

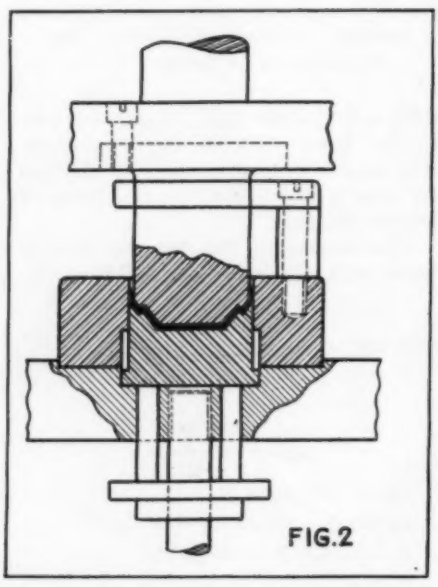
The scale in Fig. 2 is for the division of screw threads. There are times when it is necessary to draw threads in section with some degree of accuracy, and if the threads are odd in number it is tedious to space them, either with dividers or a diagonal scale; hence this little gadget of mine. Like the chart of screw heads, the scale of threads is etched on transparent celluloid.

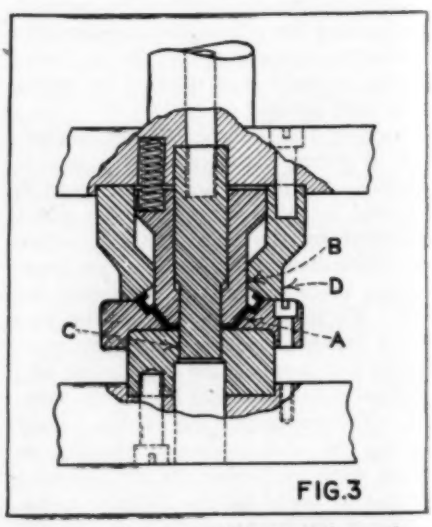
Any draftsman can make one of the thread scales pretty accurately by the use of a thread gage and a piece of carbon paper. The carbon paper is laid on the celluloid and the points of the thread



A chart that saves time in laying out fillister head machine screws







Felt retainers are blanked, formed and pierced in these tools

gage are pressed on it, making clear marks from which to etch the lines. Nearly all threads not given on the scale can be obtained from a full-size scale.

Sharp-Corner Grinding
Discussion

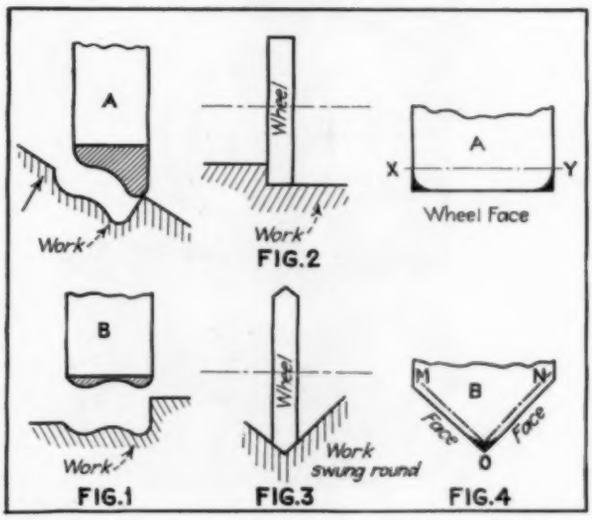
M. P. DALTON
Production Consultant, London, England

The article by Walter Wells under the title given above (*AM*—Vol. 77, page 86) reminds me of a common fault in dressing wheels for grinding and polishing in corners. Unless there is some real reason against it, the form on a wheel should be at a right angle to its plane, as the work can nearly always be swung around to suit.

In Fig. 1, the shaded profile of the wheel *A* shows a common method of dressing a wheel to produce a shape on the work, the work being fed to the wheel at an angle in the direction indicated by the arrow. This method is wrong, since side thrust is produced on the wheeel, and also because of the waste of material necessary when the wheel is to be dressed for a different shape. In redressing the wheel, the shaded material must be removed. If the wheel were originally dressed to the shape at *B*, much less material would have to be removed when a change in shape is required. There is still a further saving. With the shape set square across the face of the wheel, the wheel has approximately the same peripheral speed at all parts of the shape. A wheel dressed to the shape at *A* will cut badly and will wear more rapidly where the diameter is less, requiring frequent and wasteful redressing.

Thus in Fig. 4 of Mr. Wells' article, the plane of the wheel should be parallel to the bisector of the sharp corner. In a wheel so shaped, a definite amount of wear can be taken care of with one-half the dressing that would be required if the face of the wheel were at a right angle to its plane. Also, the rate of wear would be less.

In Fig. 2 is shown the usual shape of a wheel for grinding sharp corners, although the wheel in Fig. 3 is a better shape, the work being swung around to suit. Enlarged views of the profiles of these two wheels are shown in Fig. 4, in which the profile at *A* represents that in the wheel in Fig. 2, and the profile at *B* represents that in the wheel in Fig. 3. These enlarged views indicate the comparative amount of material that must be removed when the wheels require redressing. Material indicated by the line *X-Y* must be removed from the wheel in Fig. 2, and the amount necessary to be removed from the wheel in Fig. 3 is indicated by the lines *M-O* and *O-N*. It will thus be seen that the greater amount of material must be removed from the wheel having its face at a right angle to its plane.



Using grinding wheels so as to avoid waste when dressed. Changing angle of work and wheel reduces amount of abrasive removed. This affects sharp corner and form grinding

SEEN AND HEARD

JOHN R. GODFREY

Check Your Chucks

Chucks and other small machine equipment are apt to be neglected in many shops. Yet a worn chuck may seriously handicap the output of an expensive machine. When we remember that labor spends most of its time in handling work in and out of the machine, it needs no argument to prove that any delay due to jockeying a worn chuck costs real money both in labor and in production. A chuck that will not hold a piece true may require more stock than necessary on a rough piece and is fatal to accuracy on second operation work. Observations in many shops makes it seem a safe guess that 25 per cent of the chucks now in use belong in the scrap pile and that another 25 per cent need overhauling and repair. If you haven't checked up on the chucks in your shop lately, it's a good time to do so.

Metal Beer Mugs

Even the return of beer adds to the market for newer metals and alloys. Metal mugs are said to be replacing glass and earthenware. They are lighter, are much more durable, and are said to preserve the coolness of the brew. Brewers are also considering the use of metal barrels and of metal-lined tank trucks for shipping beer. Here again the newer metals and alloys may find a field that will require a large tonnage, while wood loses another of its outlets.

Are Machinists Temperamental?

When it comes to putting the finishing touches on aluminum propeller blades, which is a hand operation in the nature of draw filing and polishing, the cabinet maker or the farmer's boy are said to have it all over the average machinist. Contour, weight and finish all enter into the job and while the machinist is right on the job when it comes to exact dimensions (or as nearly exact as we know of now) he is said not to fit into this other kind of work as well as the men of the types mentioned. Although we are apt to connect temperament with prima donnas and theatrical stars we may have more of it in the average high grade machinist than we have realized. Anyhow the makers of propellers have given up trying to use them in the finishing of their product.

Railway Uses of Aluminum

Aluminum has been making its way into railway rolling stock construction for at least a decade. The adoption has been slow, for various reasons, and while the percentage of weight reduction has been low in most cases, even a 10 per cent reduction runs into tons in some cases of Pullman car work. Tank cars, especially for chemicals that attack steel but not aluminum, have saved 20 per cent in weight. A few motor driven passenger coaches have exceeded this saving going as high as 35 and 43 per cent in a few cases. Crossheads, connecting rods, boiler jackets and cab construction of aluminum have been tried and there is little doubt that further application will be made. There seems to be more opportunity for saving weight in cars than in steam locomotives.

SHOP EQUIPMENT NEWS

Barnes No. H-2 "Hydram" Hydraulic Feed Drilling Machine

Hydraulic pressure applied directly over the center of the cutting tool or tools is the main design feature of the No. H-2 "Hydram" drilling machine offered by the Barnes Drill Co., Rockford, Ill. The large cylinder and ram employed eliminate the usual long saddle on the column ways for maintaining alignment. A short saddle on the column takes the torque of the drive shaft. Power is carried directy to the cutting tool with a minimum of torsional vibration. This is accomplished through reduction of speed from vertical drive shaft to the comparatively short spindle of large diameter through the gear case carried on the nose of the ram. The hydraulic unit is versatile in respect to spindle travel, multiple head interchangeability, and use in vertical, horizontal, and angular applications.

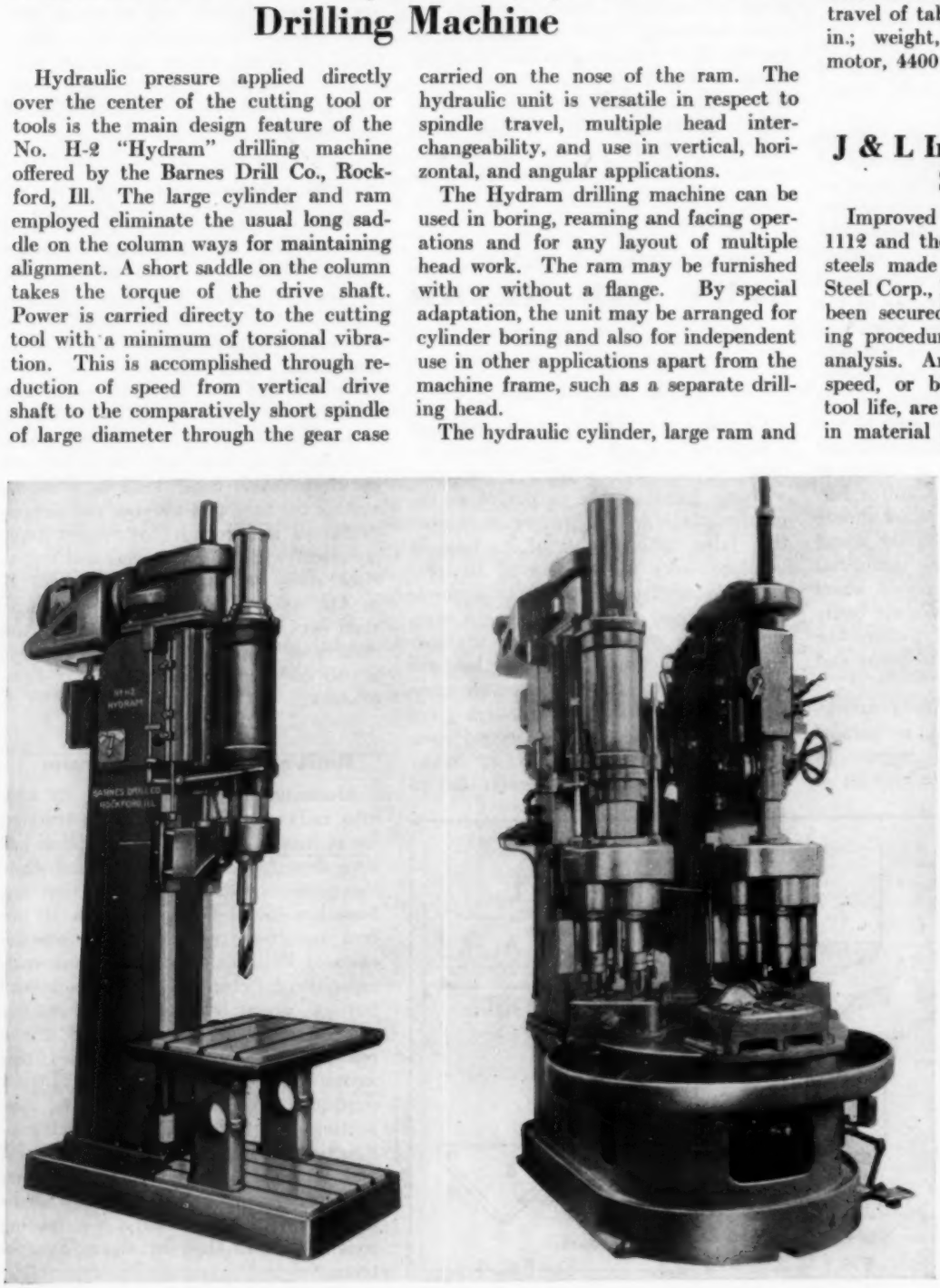
The Hydram drilling machine can be used in boring, reaming and facing operations and for any layout of multiple head work. The ram may be furnished with or without a flange. By special adaptation, the unit may be arranged for cylinder boring and also for independent use in other applications apart from the machine frame, such as a separate drilling head.

The hydraulic cylinder, large ram and spindle comprise an individual unit. The control permits of automatic rapid approach, feeding rate, hydraulic dwell for facing and quick automatic return. A volume regulator permits changing the feed rate as desired.

Specifications: Capacity, high-speed drills in SAE No. 1035 steel, 2 in.; swing, 24 in.; height, 120 in.; distance face of column to center of table, 12¼ in.; maximum distance from No. 5 taper spindle to regular table, 31¼ in.; maximum distance from spindle to base, 46½ in.; table working surface, 26x18; diameter of spindle, 2⅛ in.; diameter of spindle nose, 2$\frac{15}{16}$ in.; diameter of ram, 6¾ in.; vertical travel of spindle, 16 in.; vertical travel of table, 23 in.; floor space, 50x35 in.; weight, with coolant pump and motor, 4400 lb.

J & L Improved Bessemer Screw Steel

Improved machinability of the SAE 1112 and the special high-sulphur screw steels made by the Jones & Loughlin Steel Corp., Pittsburgh, Pa., has recently been secured by improved manufacturing procedure and not by variation of analysis. An increase in feed or greater speed, or both, combined with longer tool life, are factors which have resulted in material production increases in ap-



Left—In the Barnes No. 2-H "Hydram" Drilling Machine a large ram and cylinder directly above the short spindle puts the feed pressure directly over the center of the cutting tool. Right — The left-hand head of this machine utilizes the Hydram construction

plications in which this stock has been used. Data show that production increases ranging from 11 to 99 per cent have been secured. Improved quality of parts is based on the coolness and smoothness with which the stock works, the absence of chatter and ragged tearing.

The smooth working nature of the screw stock is responsible for its extended tool life. Less energy is required in cutting, and tools retain good cutting edges for longer periods. Chips come off short and brittle.

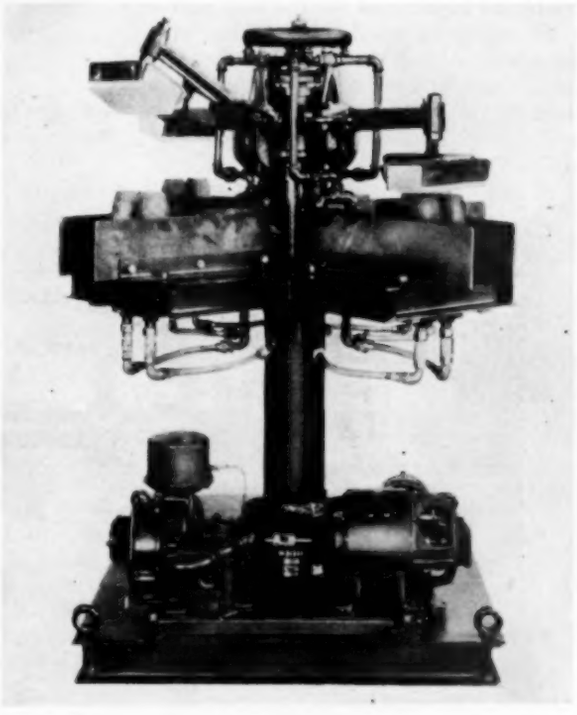
The physical strength has not been sacrificed in order to obtain better machinability. Test results on steel made under old mill practice are as follows: Tensile strength, 70,000 to 95,000 lb. per sq. in.; yield point, 75 per cent of tensile strength; elongation, 14 per cent in 2 in. minimum; reduction in area, 35 per cent minimum; Brinell hardness, 155 to 212 and Izod impact value, 8/16. Representative tests on improved practice steel show the following range: Tensile strength, 94,530 to 85,080 lb.; yield point, 81,310 to 90,560 lb. per sq. in.; elongation, 14.5 to 30 per cent in 2 in.; reduction in area, 42.4 to 52.8 per cent, Brinell hardness, 171 to 180, and Izod impact value 8/12. The latter tests were made on ¼ to 1¼ in. round stock.

Selas Automatic Gas-Fired Annealing Machine

An automatic gas-fired annealing machine for spot heating of steel parts up to 2 ft. in diameter and for work of an allied nature has been developed by The Selas Co., 18th St. & Indiana Ave., Philadelphia, Pa. The machine is a self-contained, power-driven unit carrying eight adjustable burners supplied with gas premixed with air. This gas mixture is provided by a standard Selas gas mixing machine and delivered at an orifice pressure of 3 lb. Each burner consumes gas at the rate of 100 cu. ft. per hour while heating the work, but is throttled to a rate of about 15 cu. ft. per hour during the loading periods.

Individual adjustments of the burners and the locating fixtures are provided to allow the burners to be placed at any desired position with relation to the piece being heated. Each burner is equipped with a manually operated shut-off cock in addition to the automatic throttling valves which control the heating cycle. Insulating refractory baffles reflect the heat down upon the work, accelerating the rate of heating and localizing the heated areas.

Work is fed into the machine by the operator and is delivered at the rate of six pieces per minute. The machine rotates continuously from left to right, the burners being turned on and throttled down, and the baffles moved in and out of the operating position automatically. Power is secured from a small geared motor direct connected through a flexible coupling to the main driving shaft. The machine has a wide range of adjustments and can be adapted for handling either flat or formed pieces. A substantial saving in fuel cost has been secured. The burners will operate on any commercial gas fuel.

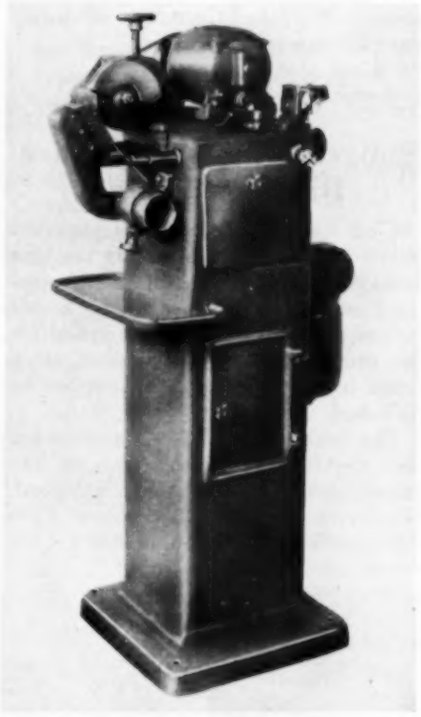


Flat or formed steel parts up to 2 ft. in diameter are spot heated at the rate of 6 pieces per minute on the Selas Automatic Gas-Fired Annealing Machine

Hanchett No. 21 Automatic Slitter-Saw Grinder

Metal-cutting saws from 2 to 5 in. in diameter can be sharpened or gummed, singly or in gangs, on the No. 21 automatic grinder developed by the Hanchett Mfg. Co., Big Rapids, Mich. The No. 10 machine, now superseded, ground only one or two saws at a time, whereas the No. 21 grinder will handle 18 saws, 0.040 in. thick, 4 in. in diameter, 60 teeth, or 30 saws, 0.030 in. thick, 4 in. in diameter, 90 teeth. Tooth spacings up to ⅜ in., from point to point, can be taken.

Saws of the same size and tooth spacing are lined up on an arbor at the front



of the machine and ground complete at one setting. The machine automatically indexes the gang of saws, one row of teeth at a time. The wheel is shaped to sharpen the tooth points and gum the throats in one operation.

The wheelhead reciprocates on dovetail slides, protected from dust and grit. The large spindle is fitted with double-row, precision ball bearings protected against dust. Feeding of the saw is by an index plate with the feed index placed

at the rear of the machine. Thus, the index plate can be made considerably larger than the saws to be ground and with index teeth larger than the teeth in the saws, resulting in greater precision and accuracy. The reciprocating head mechanism is operated by a motor through a V-belt drive to a clutch pulley.

Standard saw arbor, 5/8 in. in diameter; grinding head travel, 2 in.; grinding wheel, 5 in. in diameter by 1½ in. center hole, usual thickness, 1/8 in.; floor space, 20x32 in.; weight, crated, 500 lb.

Parker-Kalon Cold-Forged Thumb Screws

Cold-forged thumb screws from 1/8 in., 24 threads per inch by ½ in. long to 3/8 in., 16 threads per inch, by 3/8 to 3 in. long are now being made by the Parker-Kalon Corp., 200 Varick St., New York, N. Y. The screws are rolled-threaded to close limits. Thumb grips are well shaped, are free of burs and roughness, and will take a plated finish. Stock finish is plain steel. Thumb screws with special threads or of special materials can be made.

Langelier No. 33 Sensitive Drilling Machine

A full ball-bearing spindle is employed in the No. 33 sensitive drilling machine developed by the Langelier Manufacturing Company, Providence, R. I. Either belt or motor drive can be supplied for the drill which can be operated on a bench or floor stand. A treadle can be furnished.

The drill is rated at ¼ in. capacity and the following speeds can be obtained: 2,500 r.p.m. on the single-speed, belt-driven model; 1,250, 2,250 or 3,500 r.p.m. with the low speed or 2,500, 4,500 or 7,000 r.p.m. on the high speed motor-driven type. The drive is through an open belt from the motor to the spindle pulley, which is mounted on a sleeve having ball bearings at both ends. This design eliminates belt pull on the drill spindle.

The feed is produced by means of a rack and pinion and a ball bearing is provided at the upper spindle end to take the drill thrust. Stops aid in drilling to depth accurately. The distance from the column of the spindle is 4 in., or an 8 in. swing. Total spindle feed is 2½ in. Greatest distance from the chuck to the table, which has a finished surface 6x7 in., is 6½ in. Overall height of the drill is 24¼ in. and the bench space required is 10x18½ in. Weight is 90 lb.

Shuster Automatic Wire Straightening and Cutting Machine

A high-speed automatic wire straightening and cutting machine has been developed by the F. B. Shuster Co., New Haven, Conn. Movement of the wire is almost continuous and is brought about by the use of a specially designed cut-off cam and a specially designed clutch.

High speed is possible in the cut-off because the cover which closes the guide bar (the bar into which the wire is fed to be cut off) is operated independently of the cut-off lever, and the guide bar itself is permanently fixed in the uprights. The straightening flier, the flywheel and also the high-speed driving shaft are mounted on ball bearings. The handwheel adjustment for the feed rolls is located in an opening in the bed of the machine, and the lower roll boxes are released at the time of cutting off. Breaking rolls may be supplied if desired, although the machine is shown without any rear rolls.

Planigressive Speed Reducer

Three types of speed reducers designed to use a standard N.E.M.A. motor without change have been placed on the market by the Davis & Thompson Co., Milwaukee, Wis., through the national distributor, the Planigressive Reducer Sales Co., Milwaukee. Standard reduction ratios from 3:1 to 600:1 are obtainable.

Type A reducers are built integral with the motor. The planet gears are make of bakelite. This line can be had

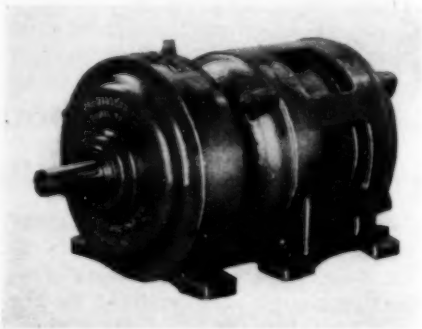


Fig. 1—Planigressive Type A Speed Reducer made as an integral unit with the motor

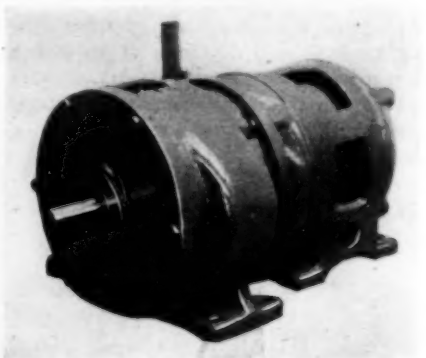
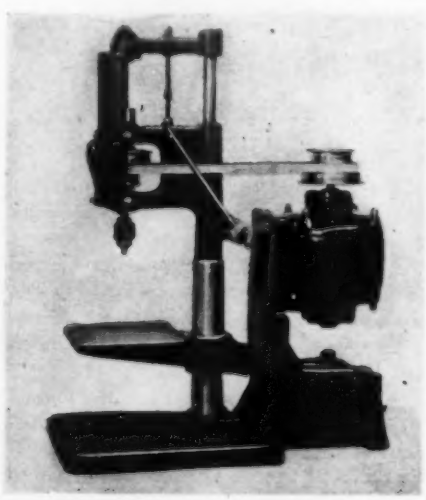


Fig. 2—Type B Compound Speed Reducer made in ratios of 8:1 to 24 to 1



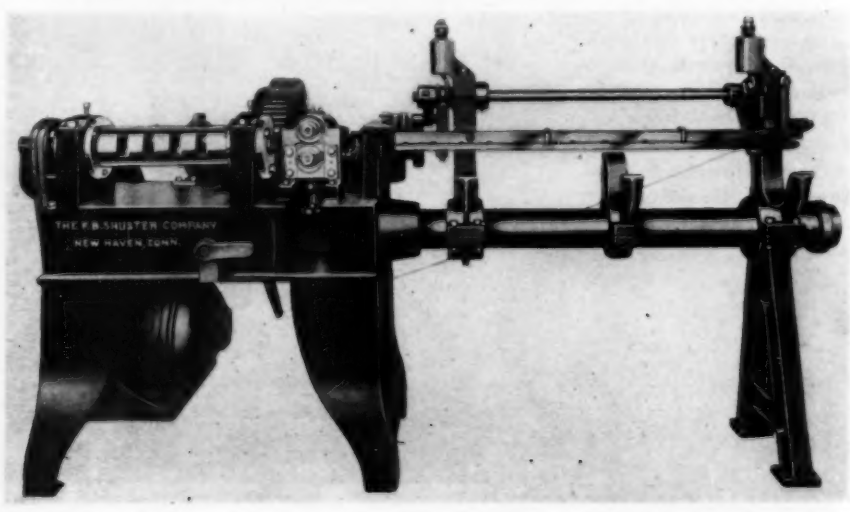


Fig. 3—Type D High-Reduction Speed Reducer made in ratios from 25:1 to 600:1

in sizes from ¾ to 15 hp., and ratios at 3:1 to 7:1.

Type B compound speed reducers are made in standard reduction ratios of 8:1 to 24:1. Type C speed increasers have ratios 1:1.1 to 1:5 Helical gears of alloy steel are used. All shafts are mounted on ball bearings. This line is made in sizes from ¾ to 15 hp.

Type D reducers are made in ratios from 25:1 to 600:1. In the first reduction composition gears are used to insure quiet operation. The succeeding reductions are made with alloy steel gears. Sizes range from ½ to 100 hp.

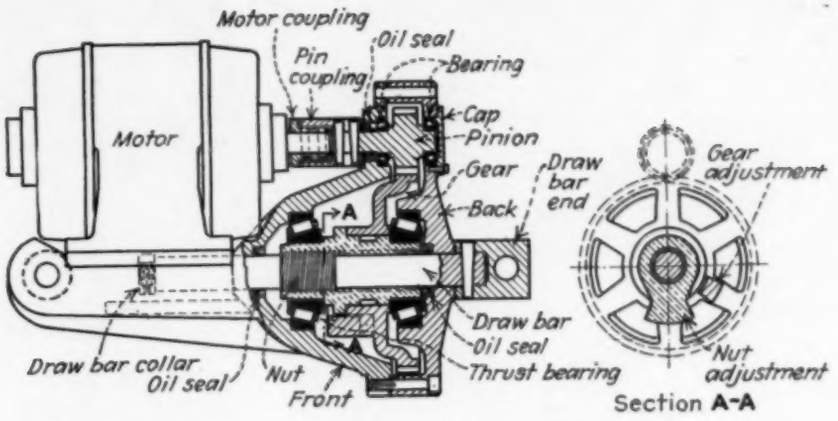
Cushman Pull-Push Power Unit

A motor-driven, non-rotating power unit that will exert a constant force in either direction for the full length of the stroke has been developed by the Cushman Chuck Co., Hartford, Conn. The unit can be assembled with the machine in any position from vertical to horizontal. Adaptations include vises, clamping fixtures, arbor presses and jacks, power clamps on shears and welding machines and applications to molding machines. The unit can be connected with the machine by means of a lever, toggle or other device.

As shown in the illustration, a high-torque, totally inclosed, small-frame, ball-bearing, a.c. motor transmits power to a pinion through a coupling. There is an abutment on one-half of the coupling which fits loosely into a slot in the other half.

Before picking up the load, the motor makes several free revolutions. On the rotatable nut and the gear there are abutments. When these abutments contact, the motor is running at full speed, causing the abutment on the driven gear to deliver a powerful blow to the abutment on the nut to aid in releasing the pressure on the gripping parts.

The rotation of the nut causes the drawbar to move either forward or backward according to the direction in which the motor is running. The force developed, dependent on the size of the motor, ranges from 3,000 to 35,000 lb., and loads can be increased by gearing, levers or toggles attached to the unit.



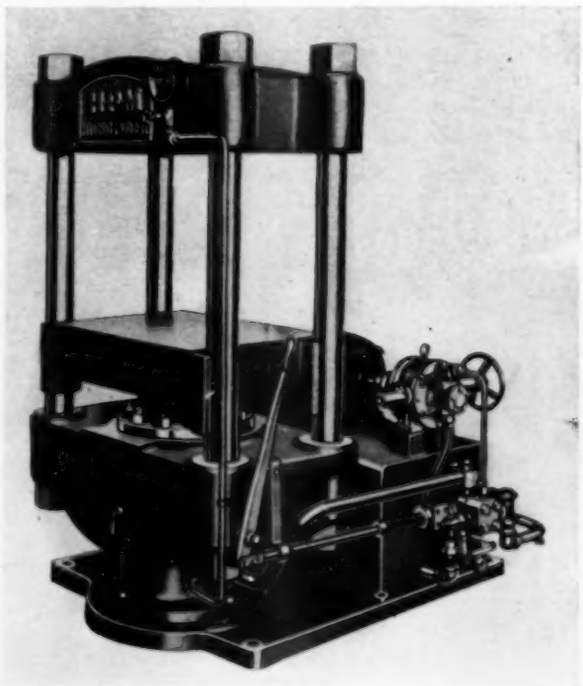
Cross-sectional views of the Cushman Pull-Push Power Unit. The drawbar is actuated by the driven gear and nut. Abutments on gear and nut come together after the motor is up to speed and the resulting impact starts the load

The base-type mounting is available in drawbar movements of 4 and 8 in. The clevis-type mounting is also made with the same drawbar movements.

"H-P-M" Self-Contained Hydraulic Presses

The Hydraulic Press Mfg. Co., Mt. Gilead, Ohio, is now introducing a hydraulic platen press of the upward-acting type of press frame and with its own individual hydraulic power plant. The operating pressure is generated by a "Hydro-Power" unit, consisting of a variable-delivery radial pump with direct-connected electric motor, both mounted on a base inclosed for containing the oil used as pressure fluid and lubricant. This unit can be mounted in any convenient location adjacent to the press.

The pressure exerted by the press and its speed of ram travel are subject to close automatic regulation through controls governing the output of the power unit. Operating features include: automatic pressure regulation with adjust-



"H-P-M" Hydraulic Platen Press mounted on a bedplate with the "Hydro-Power" hydraulic unit at the rear. This type of press is employed for many different kinds of forming operations and may be equipped with various types of pressing fixtures

able pressure capacity, variable working speed. This line of presses is available in standard pressure capacities of 25 to 500 tons, each with square or open-side platens varying in increments of 12 in.

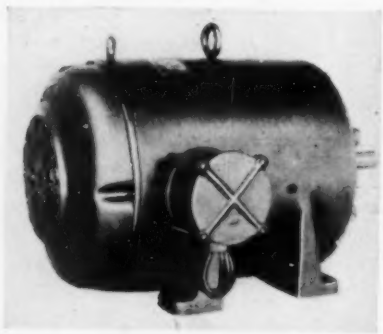
Whitney Roller Chain Flexible Coupling

The Whitney Manufacturing Co., Hartford, Conn., has placed on the market a roller-chain flexible coupling consisting of two accurately cut roller chain sprockets coupled together with the

company's roller chain. Clearance between the two sprockets allows for slight shaft misalignment. This clearance also permits a reasonable amount of motor end float without binding or shaft distortion. The rotating-type coupling cover permits oil lubrication and protection from dirt.

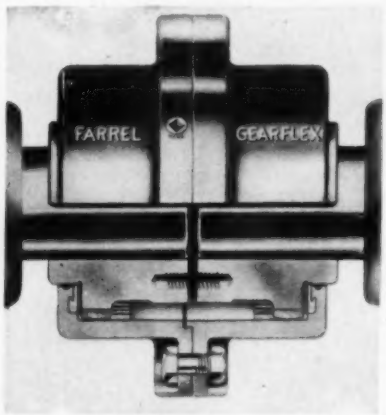
Ideal Totally Inclosed Fan-Cooled Motor

A fully protected motor of dust-type construction and of the same size as an ordinary open type motor of the same rating has been developed by the Ideal Electric & Mfg. Co., Mansfield, Ohio. The motor has two shells. Motors are made in all sizes from 1 to 200 hp. as squirrel cage induction motors to meet all classifications of torque and inrush requirements and with 1, 2, 3, or 4 speeds. They are also available as across-the-line-start motors up to 200 hp. and can be supplied for power-factor correction as 100 per cent or 80 per cent leading power factor induction motors in all sizes.



Farrel "Gearflex" Couplings

A flexible coupling of the gear type, known as the Farrel "Gearflex" coupling, is being introduced by the Farrel-Birmingham Co., Inc., 344 Vulcan St., Buffalo, N. Y. The double-engagement type of coupling shown consists of two externally geared hubs keyed to two shafts and engaging an internally geared floating sleeve that incases the hubs. With two sets of spur gears, one at each end of the floating sleeve, misalignment is compensated for by the sleeve assuming a neutral position between the two shafts. The external and internal spur gears are accurately generated to assure distribution of the load over a large number of contact surfaces.



Double-engagement type of Farrel "Gearflex" Coupling that is intended for high speeds and maximum flexibility

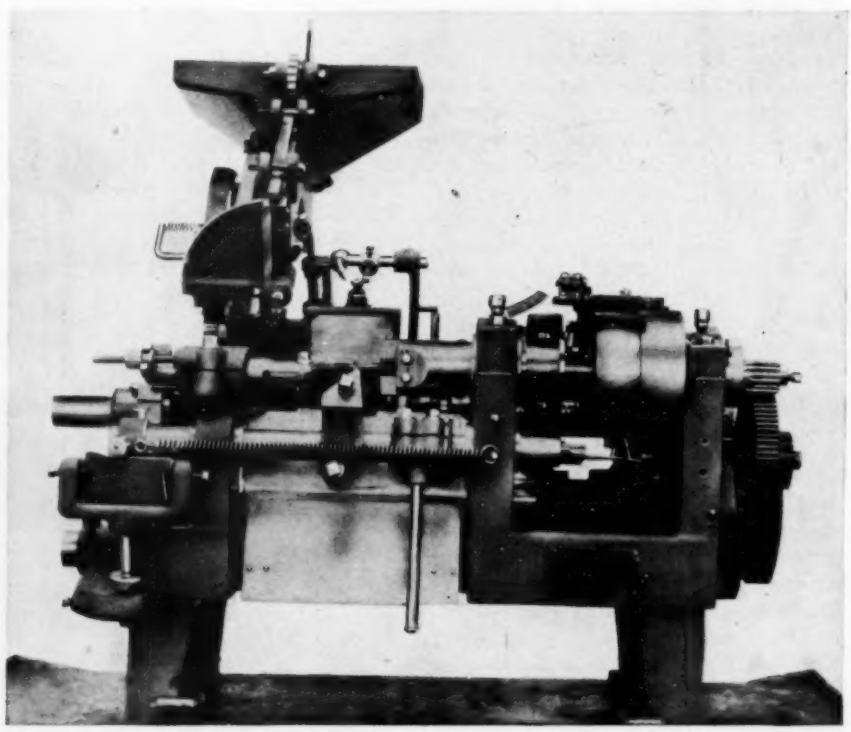
The reservoir between the hubs and the floating sleeve carries a supply of lubricant. When the coupling rotates, centrifugal force throws the oil into the inner surface of the floating sleeve where it spreads between the gear teeth immersing the load-carrying surfaces.

The Gearflex coupling is also made in a single-engagement type and has only one externally geared hub in engagement with an internal gear in the sleeve, the other hub being solid and the sleeve bolted to it. The single-engagement type is designed to provide a lower cost coupling for applications where the high-speed capacity and the high degree of flexibility of the double-engagement type are not required.

Townsend Improved Wood Screw Pointer and Threader

Single, double or triple threads can be cut on the improved wood screw pointing and threading machine built by The H. P. Townsend Mfg. Co., Hartford, Conn. The machines are built in three sizes for handling the full list of U. S. S. and manufacturers' standards. They are arranged to drive from an overhead jackshaft, leaving space underneath the tables free for storage.

High production is obtained without the use of an abnormally high spindle speed for the following reasons: (1) Because of the arrangement of the cams and tool movements which eliminate unnecessary lost time; (2) because either oversize or undersize heads are held by toggle-operated jaws and a smaller num-



ber of cuts are required; and (3) because of the continuous performance resulting from the feeding mechanism and easy screw adjustments.

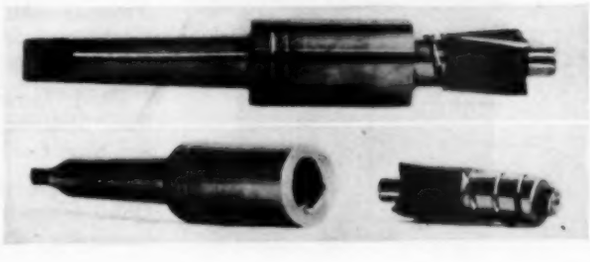
The spindle is of the two-jaw type, provided with oversize ball bearings. Solid cut cams are easily changed as they are mounted on the end of the camshaft. Jaw grips in the spindle will hold two or three different sizes of heads by a simple adjustment at the rear end of the spindle and are interchangeable and replaceable. The work is supported by a backrest during the cutting operation, the backrest being adjustable in two directions to give contact with the blank.

U. S. Variable Speed Buffer and Grinder

Model 95 buffer and polisher offered by the United States Electrical Tool Co., Cincinnati, Ohio, provides a selective gear drive which maintains an efficient peripheral speed for any desired diameter wheel. The drive provides four wheel speeds from 2,000 to 3,000 r.p.m. or any range desired. Speeds are selected by a lever mounted on the front of the machine. The gears are interlocked with the lever in such a manner as to make it impossible to run the wheels at a dangerous rate of speed. When used as a grinder, the guards are adjusted for various wheel diameters and wheel wear. Models 64 and 65 designed for heavy continuous work are also obtainable with this selective transmission.

Centerlock Drive for End-Cutting Tools

The Centerlock Drill Bushing Co., 12125 Cardoni Ave., Detroit, Mich., has developed a tool holder and method of drive for end-cutting tools that minimizes breakage of the tools and holder and permits making multi-diameter tools in sections. It will be seen from the accompanying illustration that a bushing is machined with a helical groove in which a round wire helix is placed. The tool-holder body is machined in a similar manner and drive is taken on the wire helix. The tool shank is of the constant cross-section and therefore has no definitely weak part. Multi-diameter tools can be built up in sections and can be held to closer limits of concentricity. If a section should break it is easily replaced. The design eliminates impact loads on fastening or driving elements.



No weak cross-section and elimination of shock in the Centerlock Drive for End Cutting Tools minimize breakage of tools

Quickwork No. 230 Welded Steel Rotary Shear

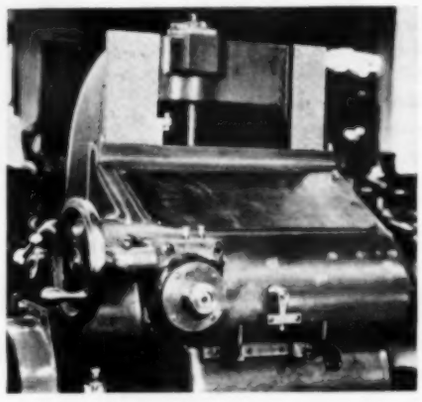
Flanged and elliptical heads ordinarily made manually or on a large press can be produced on the No. 230 rotary shear developed by the Quickwork Company, St. Marys, Ohio. The shear is of welded steel construction and employs geared-head motors. As a consequence, the company can furnish a machine to fit the customer's particular requirements, where one of the company's standard machines is not suitable.

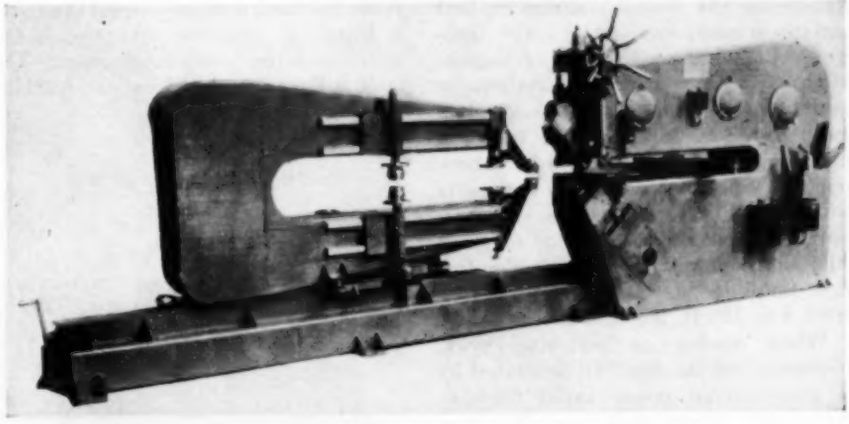
The capacity of the No. 230 shear is $\frac{5}{16}$ in. mild steel. It will flange ¼ in. mild steel and 10-gage alloy steels such as corrosion-resisting steels. The shear will make straight and irregular cuts and will cut square or beveled edges.

With the elliptical attachment the following operations are performed: cut round heads from square blanks, minimum 12 in., maximum 84 in. in diameter; flange round heads, minimum, 4 in., maximum 84 in. in diameter; cut elliptical heads struck from four centers, minimum 42x34 in., maximum 84x54 in. The machine will also flange the above elliptical heads. It will split wide sheets or narrow strips on the edge of sheets, guiding against the gage mounted in the throat of the machine. It will slit strips from 3 to 44 in. wide from wider sheets. Metal travel speeds are 12, 24, 36 and 72 ft. per min.

Improved Wheelhead Reversing Mechanism on Thompson Surface Grinder

A simplified form of reversing mechanism has been applied by the Thompson Grinder Co., Springfield, Ohio, to its





standard hydraulic surface grinder. The reversing dogs are shown mounted on the wheelhead. These dogs are adjustable to any cross feed stroke. Because it is also desirable to have manual control of the wheelhead reverse, a knob and dial on the front of the wheelhead bracket are provided. Feeding the wheelhead by means of the handwheel is ac-

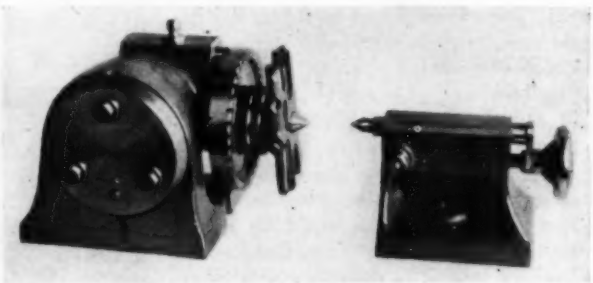
complished by engaging a splined clutch to the geared handwheel and by shifting the control knob on the wheelhead bracket to an indicated position at which the oil present in the wheelhead cylinder does not interfere with handwheel movement. The reversing mechanism is inclosed within the head bracket and is sealed against grit.

Rex Index Centers

The Rex Machine & Tool Co., 9 Sheridan St., San Francisco, Cal., has developed a line of plain and universal index centers for the toolroom. They are made for use in either the right or left hand of milling machine tables. The spindle has a No. 9 taper hole and is threaded to receive a chuck or other fixture. Tongues and bolts to suit a ⅝ in. T-slot are furnished. The centers will swing 8 in. in diameter.

The index plates are provided with a double-edged rim, and in each edge a series of divisions is cut. The lock bolt is withdrawn against spring pressure by the hand lever, and when the bolt is in place the spindle and work are clamped without deflection by means of a floating double bushing. The plates are provided with 16 and 36 notches in the one and 42 and 60 in the other. Plates can be supplied with any number of divisions up to 75.

The universal head is provided with a graduated dial at the front by means of which the spindle housing may be set at any desired angle from 10 deg. below the horizontal to 65 deg. beyond the perpendicular, or a total angular range of 165 deg.



Rex Universal Index Centers which can be set to any angle from 10 deg. below the horizontal to 65 deg. beyond the perpendicular

Gallmeyer & Livingston No. 3-V Hydraulic Feed Vertical-Spindle Surface Grinder

A cup wheel is used on the vertical spindle on the No. 3-V hydraulic-feed surface grinder developed by the Gallmeyer & Livingston Co., Grand Rapids, Mich. The machine is suitable for grinding dies with guide pins in place and also for miscellaneous toolroom grinding on parallels, hardened washers, punches, small flat dies and other parts where rapidity of production is important. A rapid table travel for roughing cuts and a slower travel for one or two light finishing cuts may be had. Speeds from 2 to 100 ft. per min. are available.

When placing or removing work, movement of the head is facilitated by a motor-driven power rapid traverse. Automatic down feed, variable from 0.0001 to 0.002 in. per stroke, with automatic throw-out, is provided. A 5-hp., 60-cycle motor mounted directly on the spindle gives maximum power at the spindle.

A detachable, portable coolant system provides a copious flow of coolant. When the tank is to be cleaned the cover is lifted off complete with the ¼-hp. motor and the pump mechanism. The tank is then detached from the machine for cleaning.

Die and toolroom grinding with a cup wheel is done on the G. & L. No. 3-V Vertical Surface Grinder

• PATENTS •

AUGUST 1, 1933

Metal-Working Machinery

Feeding Mechanism for Machine Tools. Wallace H. Wood, Worcester, Mass., assigned to Norton Co. Patent 1,920,228.

Grinding Machine or the Like. William L. Bryant, Springfield, Vt.; assigned to Bryant Chucking Grinder Co. Patent 1,920,290.

Traversing Support for Metal Working Machines. Henry E. Morton, Muskegon Heights, Mich. Patent 1,920,476.

Means for Mounting Electrically Actuated Mechanisms for Driving Lathes and Other Machines. Otto Cullman, Chicago, Ill. Patent 1,920,498.

Machine Tool Carriage Control. Clarence C. Stevens, Forestville, Conn., assigned to The New Departure Manufacturing Co. Patent 1,920,532.

Hydraulic Actuating and Control Valve Means. Robert A. Schafer, Richmond, Ind., assigned to The National Automatic Tool Co. Patent 1,920,596.

Tools and Attachments

Abrasive Wheel Mount. Thure Larsson, Worcester, Mass., assigned to Norton Co. Patent 1,920,204.

AUGUST 8, 1933

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Feeding Mechanism for Machine Tools. Warren F. Fraser, Westboro, Mass., assigned to Norton Co. Patent 1,920,979.

Machine for Guiding Cutting or Welding Burners, Electrodes, and Like Implements. Adam Schmidt, Vienna, Austria, assigned to Alfred Vogel. Patent 1,921,888.

Orbital Lathe. William F. Groene, Cincinnati, Ohio, assigned to The R. K. Le Blond Machine Tool Co. Patent 1,921,919.

Tools and Attachments

Sheet Metal Die. George E. Ireland, Toledo, Ohio, assigned to The City Machine & Tool Co. Patent 1,921,188.

Removable Guide Pin (for Diesets). Newman M. Marsilius, Bridgeport, Conn., assigned to The Producto Machine Co. Patent 1,921,421.

Fluid Operated Tool. John R. Hoffman, Madison, Wis., assigned to Madison-Kipp Corp. Patent 1,921,753.

Die Head. Ralph E. Hyde, Cleveland, Ohio, assigned to The Oster Manufacturing Co. Patent 1,921,754.